

THIS PROJECT IS ADVERTISED ON AN UNRESTRICTED BASIS PURSUANT  
TO THE SMALL BUSINESS COMPETITIVENESS DEMONSTRATION PROGRAM

SOLICITATION NO. DACA01-97-R-0044

SPECIFICATIONS

FOR

DESIGN AND CONSTRUCTION OF  
RENOVATE DORMITORY 19  
EGLIN AIR FORCE BASE, FLORIDA

*“GOOD ENGINEERING RESULTS IN A BETTER ENVIRONMENT”*



**US Army Corps  
of Engineers**  
Mobile District

U.S. ARMY ENGINEER DISTRICT, MOBILE  
109 St. Joseph Sreet  
Mobile, Alabama



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TECHNICAL SPECIFICATIONS - DIVISIONS 01 - 16

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<b>SOLICITATION, OFFER, AND AWARD</b> (Construction, Alteration, or Repair)	1. SOLICITATION NO.	2. TYPE OF SOLICITATION	3. DATE ISSUED	PAGE OF PAGES
	DACA01-97-R-0044	<input type="checkbox"/> SEALED BID (IFB) <input checked="" type="checkbox"/> NEGOTIATED (RFP)	08 APR 1997	1 of 2

IMPORTANT - The "offer" section on the reverse must be fully completed by offeror.

4. CONTRACT NO.		5. REQUISITION/PURCHASE REQUEST NO.	6. PROJECT NO.
7. ISSUED BY	CODE	8. ADDRESS OFFER TO	
	CT	Same as BLOCK 7:	
U S ARMY ENGINEER DISTRICT, MOBILE CONTRACTING DIVISION (CESAM-CT) (109 ST. JOSEPH ST. 36602) P.O. BOX 2288 MOBILE AL 36628-0001		(HAND CARRIED OFFERS- ROOM 1000A) FEDERAL BUILDING ROOM 1000A 109 ST. JOSEPH STREET MOBILE, AL 36602	
9. FOR INFORMATION CALL:	A. NAME	B. TELEPHONE NO. (Include area code) (NO COLLECT CALLS)	

### SOLICITATION

NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder".

10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS (Title, identifying no., date):

DESIGN AND CONSTRUCTION OF RENOVATE DORMITORY 19  
EGLIN AIR FORCE BASE, FLORIDA

11. The Contractor shall begin performance within <u>8</u> calendar days and complete it within <u>365</u> calendar days after receiving	
<input type="checkbox"/> award, <input checked="" type="checkbox"/> notice to proceed. This performance period is <input checked="" type="checkbox"/> mandatory, <input type="checkbox"/> negotiable. (See _____.)	
12A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE AND PAYMENT BONDS? (If "YES," indicate within how many calendar days after award in Item 12B.)	12B. CALENDAR DAYS
<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	10

13. ADDITIONAL SOLICITATION REQUIREMENTS:

- A. Sealed offers in original and 1 copies to perform the work required are due at the place specified in Item 8 by 1400 (hour) local time 22 MAY 1997 (date). If this is a sealed bid solicitation, offers must be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.
- B. An offer guarantee ☒ is, ☐ is not required.
- C. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by reference.
- D. Offers providing less than 90 calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.

14. NAME AND ADDRESS OF OFFEROR (Include ZIP Code)				15. TELEPHONE NO. (Include area code)				16. REMITTANCE ADDRESS (Include only if different than Item 14)			
CODE                      FACILITY CODE											
17. The offeror agrees to perform the work required at the prices specified below in strict accordance with the terms of this solicitation, if this offer is accepted by the Government in writing within ____calendar days after the date offers are due. (Insert any number equal to or greater than the minimum requirement stated in Item 13D. Failure to insert any number means the offeror accepts the minimum in Item 13D.)											
<div style="display: flex; align-items: center;"> <div style="width: 100px; text-align: right; font-weight: bold;">AMOUNTS</div> <div style="width: 100px; text-align: center;">▶</div> <div style="flex-grow: 1;"></div> </div>											
18. The offeror agrees to furnish any required performance and payment bonds.											
<b>19. ACKNOWLEDGMENT OF AMENDMENTS</b> (The offeror acknowledges receipt of amendments to the solicitation - give number and date of each)											
AMENDMENT NO.											
DATE											
20A. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER (Type or print)						20B. SIGNATURE				20C. OFFER DATE	
<b>AWARD (To be completed by Government)</b>											
21. ITEMS ACCEPTED:											
22. AMOUNT				23. ACCOUNTING AND APPROPRIATION DATA							
24. SUBMIT INVOICES TO ADDRESS SHOWN IN (4 copies unless otherwise specified)				ITEM		25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO  <input type="checkbox"/> 10 U.S.C. 2304(c) (     ) <input type="checkbox"/> 41 U.S.C. 253(c) (     )					
26. ADMINISTERED BY				CODE		27. PAYMENT WILL BE MADE BY					
<b>CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE</b>											
<input type="checkbox"/> <b>28. NEGOTIATED AGREEMENT</b> (contractor is required to sign this document and return _____ copies to issuing office.) Contractor agrees to furnish and deliver all items or perform all work, requisitions identified on this form and any continuation sheets for the consideration stated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications incorporated by reference in or attached to this contract.						<input type="checkbox"/> <b>29. AWARD</b> (Contractor is not required to sign this document.) Your offer on this solicitation, is hereby accepted as to the items listed. This award consummates the contract, which consists of (a) the Government solicitation and your offer, and (b) this contract award. No further contractual document is necessary.					
30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN (Type or print)						31A. NAME OF CONTRACTING OFFICER (Type or print)					
30B. SIGNATURE				30C. DATE		31B. UNITED STATES OF AMERICA  BY				31C. AWARD DATE	

BIDDER'S NAME: \_\_\_\_\_

DACA01-97-R-0044

BIDDING SCHEDULE

Item No.	Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
	<b>BASE BID:</b>				
1.	Cost of Design	1	JOB	XXX	
2.	Site Improvements (Including Grading, Paving, Drainage, Landscaping and Irrigation)	1	JOB	XXX	
3.	Utilities	1	JOB	XXX	
4.	Renovate Sector "A", "B" and "E"	1	JOB	XXX	
5.	Renovate 4 Units Sector "D"	1	JOB	XXX	
6.	Renovate 10 Units Sector "D"	1	JOB	XXX	
7.	Renovate Sector "D" (HVAC, Sprinkler and Interior Finishes)	1	JOB	XXX	
8.	Renovate Sector "D" (Same as at Sector "A", "B" and "E"), Utilities & Site Improvements	1	JOB	XXX	
			<b>TOTAL</b>	<b>BASE BID</b>	

NOTES FOR BIDDING SCHEDULE

NOTE NO. 1. To better facilitate the public bid opening process, all modifications to bids are to be submitted on copies of the latest bid schedules as published in the solicitation or the latest amendment thereto. In lieu of indicating additions/deductions to bid items, all bidders should state their revised prices for each item. The company name should be indicated on the face of the bidding schedule to preclude being misplaced.

NOTE NO. 2. Bidders must insert a price on all numbered items of the Bidding Schedule. Failure to do so will disqualify the bid.

NOTE NO. 3. If a modification to a bid is submitted and provides for a lump-sum adjustment to the total estimated cost, the application of the lump-sum adjustment to each unit price and/or lump-sum price, in the bid schedule must be stated or, if it is not stated, the bidder agrees that the lump-sum adjustment shall be applied on a prorata basis to every bid item in the bid schedule.

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### **Explanation of Bidding Items**

#### **Bid Item No. 1**

Complete design documents for Sectors “A”, “B”, “D”, and “E”. Includes design documents for Bid Items Nos. 2, 3, 4, 5, 6, 7 and 8.

#### **Bid Item No. 2**

Site Improvements for Sector “A”, “B” and “E”. Includes grading, paving, drainage, landscaping and Irrigation.

#### **Bid Item No. 3**

Utilities for Sectors “A”, “B”, and “E”.

#### **Bid Item No. 4**

Complete renovation of Sectors “A”, “B” and “E”.

#### **Bid Item No. 5**

**All references to Alternate No. 4 on the drawings will be priced on Bid Item No. 5.**

Complete renovation of 4 units in Sector “D”.

No work in remainder of Sector “D”.

#### **Bid Item No. 6**

**All references to Alternate No. 3 on the drawings will be priced on Bid Item No. 6. Do not include duplicate costs from Bid Item No. 5.**

Complete renovation of 10 units in Sector “D”.

No work in remainder of Sector “D”.

#### **Bid Item No. 7**

**All references to Alternate No. 2 on the drawings will be priced on Bid Item No. 7.**

Renovation of Sector “D” including HVAC, sprinkler and finishes as required by environmental demolition.

#### **Bid Item No. 8**

**All references to Alternate No. 1 on the drawings will be priced on Bid Item No. 8. Do not include duplicate costs from Bid Items 5, 6 and 7.**

Complete renovation of Sector “D”, same as Sectors “A”, “B”, and “E”.

Including Utilities and Site Improvements.

<b>BID BOND</b> (See instructions on reverse)	DATE BOND EXECUTED (Must not be later than bid opening date)	FORM APPROVED OMB NO.  <b>9000-0045</b>
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Public reporting burden for this collection of information is estimated to average 25 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the FAR Secretariat (VRS), Office of Federal Acquisition Policy, GSA, Washington, D.C. 20405; and to the Office of Management and Budget, Paperwork Reduction Project (9000-0045), Washington, D.C. 20503.

PRINCIPAL (Legal name and business address)	TYPE OF ORGANIZATION ("X" one)  <input type="checkbox"/> INDIVIDUAL <input type="checkbox"/> PARTNERSHIP <input type="checkbox"/> JOINT VENTURE <input type="checkbox"/> CORPORATION STATE OF INCORPORATION
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SURETY(IES) (Name and business address)

PENAL SUM OF BOND					BID IDENTIFICATION	
PERCENT OF BID PRICE	AMOUNT NOT TO EXCEED				BID DATE	INVITATION NO.
	MILLION(S)	THOUSAND(S)	HUNDRED(S)	CENTS		
					FOR (Construction, Supplies or Services)	

**OBLIGATION:**

We, the Principal and Surety(ies) are firmly bound to the United States of America (hereinafter called the Government) in the above penal sum. For payment of the penal sum, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally. However, where the Sureties are corporations acting as co-sureties, we, the Sureties, bind ourselves in such sum "jointly and severally" as well as "severally" only for the purpose of allowing a joint action or actions against any or all of us. For all other purposes, each Surety binds itself, jointly and severally with the Principal, for the payment of the sum shown opposite the name of the Surety. If no limit of liability is indicated, the limit of liability is the full amount of the penal sum.

**CONDITIONS:**

The Principal has submitted the bid identified above.

**THEREFORE:**

The above obligation is void if the Principal - (a) upon acceptance by the Government of the bid identified above, within the period specified therein for acceptance (sixty (60) days if no period is specified), executes the further contractual documents and gives the bond(s) required by the terms of the bid as accepted within the time specified (ten (10) days if no period is specified) after receipt of the forms by the principal; or (b) in the event of failure to execute such further contractual documents and give such bonds, pays the Government for any cost of procuring the work which exceeds the amount of the bid.

Each Surety executing this instrument agrees that its obligation is not impaired by any extension(s) of the time for acceptance of the bid that the Principal may grant to the Government. Notice to the surety(ies) of extension(s) are waived. However, waiver of the notice applies only to extensions aggregating not more than sixty (60) calendar days in addition to the period originally allowed for acceptance of the bid.

**WITNESS:**

The Principal and Surety(ies) executed this bid bond and affixed their seals on the above date.

PRINCIPAL				
SIGNATURE(S)	1.	2.	3.	Corporate Seal
	(Seal)	(Seal)	(Seal)	
NAME(S) & TITLE(S) (Typed)	1.	2.	3.	

INDIVIDUAL SURETY(IES)			
SIGNATURE(S)	1.	2.	
	(Seal)	(Seal)	
NAME(S) (Typed)	1.	2.	

CORPORATE SURETY(IES)				
SURETY A	NAME & ADDRESS	STATE OF INC.		LIABILITY LIMIT
				\$
	SIGNATURE(S)	1.	2.	Corporate Seal
NAME(S) & TITLE(S) (Typed)	1.	2.		



**CORPORATE SURETY(IES) (Continued)**

<b>SURETY B</b>	NAME & ADDRESS			STATE OF INC.	LIABILITY LIMIT \$	Corporate Seal
	SIGNATURE(S)	1.	2.			
	NAME(S) & TITLE(S) (Typed)	1.	2.			
<b>SURETY C</b>	NAME & ADDRESS			STATE OF INC.	LIABILITY LIMIT \$	Corporate Seal
	SIGNATURE(S)	1.	2.			
	NAME(S) & TITLE(S) (Typed)	1.	2.			
<b>SURETY D</b>	NAME & ADDRESS			STATE OF INC.	LIABILITY LIMIT \$	Corporate Seal
	SIGNATURE(S)	1.	2.			
	NAME(S) & TITLE(S) (Typed)	1.	2.			
<b>SURETY E</b>	NAME & ADDRESS			STATE OF INC.	LIABILITY LIMIT \$	Corporate Seal
	SIGNATURE(S)	1.	2.			
	NAME(S) & TITLE(S) (Typed)	1.	2.			
<b>SURETY F</b>	NAME & ADDRESS			STATE OF INC.	LIABILITY LIMIT \$	Corporate Seal
	SIGNATURE(S)	1.	2.			
	NAME(S) & TITLE(S) (Typed)	1.	2.			
<b>SURETY G</b>	NAME & ADDRESS			STATE OF INC.	LIABILITY LIMIT \$	Corporate Seal
	SIGNATURE(S)	1.	2.			
	NAME(S) & TITLE(S) (Typed)	1.	2.			

**INSTRUCTIONS**

1. This form is authorized for use when a bid guaranty is required. Any deviation from this form will require the written approval of the Administrator of General Services.
2. Insert the full legal name and business address of the Principal in the space designated "Principal" on the face of the form. An authorized person shall sign the bond. Any person signing in a representative capacity (e.g., an attorney-in-fact) must furnish evidence of authority if that representative is not a member of the firm, partnership, or joint venture, or an officer of the corporation involved.
3. The bond may express penal sum as a percentage of the bid price. In these cases, the bond may state a maximum dollar limitation (e.g., 20% of the bid price but the amount not to exceed \_\_\_\_\_ dollars).
4. (a) Corporations executing the bond as sureties must appear on the Department of the Treasury's list of approved sureties and must act within the limitation listed therein. Where more than one corporate surety is involved, their names and addresses shall appear in the spaces (Surety A, Surety B, etc.) headed "CORPORATE SURETY(IES)." In the space designated "SURETY(IES)" on the face of the form, insert only the letter identification of the sureties.  
  
(b) Where individual sureties are involved, a completed Affidavit of Individual Surety (Standard Form 28), for each individual surety, shall accompany the bond. The Government may require the surety to furnish additional substantiating information concerning its financial capability.
5. Corporations executing the bond shall affix their corporate seals. Individuals shall execute the bond opposite the word "Corporate Seal"; and shall affix an adhesive seal if executed in Maine, New Hampshire, or any other jurisdiction requiring adhesive seals.
6. Type the name and title of each person signing this bond in the space provided.
7. In its application to negotiated contracts, the terms "bid" and "bidder" shall include "proposal" and "offeror."

**AFFIDAVIT OF INDIVIDUAL SURETY**

(See instructions on reverse)

FORM APPROVED OMB NO.

**9000-0001**

Public reporting burden for this collection of information is estimated to average 3 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the FAR Secretariat (VRS), Office of Federal Acquisition Policy, GSA, Washington, D.C. 20405; and to the Office of Management and Budget, Paperwork Reduction Project (9000-0001), Washington, D.C. 20503.

STATE OF

COUNTY OF

**SS.**

I, the undersigned, being duly sworn, depose and say that I am: (1) the surety to the attached bond(s); (2) a citizen of the United States; and of full age and legally competent. I also depose and say that, concerning any stocks or bonds included in the assets listed below, that there are no restrictions on the resale of these securities pursuant to the registration provisions of Section 5 of the Securities Act of 1933. I recognize that statements contained herein concern a matter within the jurisdiction of an agency of the United States and the making of a false, fictitious or fraudulent statement may render the maker subject to prosecution under Title 18, United States Code Sections 1001 and 494. This affidavit is made to induce the United States of America to accept me as surety on the attached bond.

1. NAME (First, Middle, Last) (Type or Print)

2. HOME ADDRESS (Number, Street, City, State, ZIP Code)

3. TYPE AND DURATION OF OCCUPATION

4. NAME AND ADDRESS OF EMPLOYER (If Self-employed, so State)

5. NAME AND ADDRESS OF INDIVIDUAL SURETY BROKER USED (If any)  
(Number, Street, City, State, ZIP Code)

6. TELEPHONE NUMBER

HOME -

BUSINESS -

7. THE FOLLOWING IS A TRUE REPRESENTATION OF THE ASSETS I HAVE PLEDGED TO THE UNITED STATES IN SUPPORT OF THE ATTACHED BOND:

(a) Real estate (include a legal description, street address and other identifying description; the market value; attach supporting certified documents including recorded lien; evidence of title and the current tax assessment on the property. For market value approach, also provide a current appraisal.)

(b) Assets other than real estate (describe the assets, the details of the escrow account, and attach certified evidence thereof).

8. IDENTIFY ALL MORTGAGES, LIENS, JUDGEMENTS, OR ANY OTHER ENCUMBRANCES INVOLVING SUBJECT ASSETS INCLUDING REAL ESTATE TAXES DUE AND PAYABLE.

9. IDENTIFY ALL BONDS, INCLUDING BID GUARANTEES, FOR WHICH THE SUBJECT ASSETS HAVE BEEN PLEDGED WITHIN 3 YEARS PRIOR TO THE DATE OF EXECUTION OF THIS AFFIDAVIT.

**DOCUMENTATION OF THE PLEDGED ASSET MUST BE ATTACHED.**

10. SIGNATURE

11. BOND AND CONTRACT TO WHICH THIS AFFIDAVIT RELATES  
(Where appropriate)**12. SUBSCRIBED AND SWORN TO BEFORE ME AS FOLLOWS:**

a. DATE OATH ADMINISTERED			b. CITY AND STATE (Or other jurisdiction)	Official Seal	
MONTH	DAY	YEAR			
c. NAME AND TITLE OF OFFICIAL ADMINISTERING OATH (Type or print)			d. SIGNATURE		e. MY COMMISSION EXPIRES

## INSTRUCTIONS

1. Individual sureties on bonds executed in connection with Government contracts, shall complete and submit this form with the bond. (See 48 CFR 28.203, 53.228(e).) The surety shall have the completed form notarized.

2. No corporation, partnership, or other unincorporated associations or firms, as such, are acceptable as individual sureties. Likewise members of a partnership are not acceptable as sureties on bonds which partnership or associations, or any co-partner or member thereof is the principal obligor. However, stockholders of corporate principals are acceptable provided (a) their qualifications are independent of their stockholdings or financial interest therein, and (b) that the fact is expressed in the affidavit of justification. An individual surety will not include any financial interest in assets connected with the principal on the bond which this affidavit supports.

3. United States citizenship is a requirement for individual sureties. However, only a permanent resident of the place of execution of the contract and bond is required for individual sureties in the following locations - any foreign country; the Commonwealth of Puerto Rico; the Virgin Islands; the Canal Zone; Guam; or any other territory or possession of the United States.

4. All signatures on the affidavit submitted must be originals. Affidavits bearing reproduced signatures are not acceptable. An authorized person shall sign the bond. Any person signing in a representative capacity (e.g., an attorney-in-fact) must furnish evidence of authority if that representative is not a member of firm, partnership, or joint venture, or an officer of the corporation involved.

Approved by OM  
0348-0046

Complete this form to disclose lobbying activities pursuant to 31 U.S.C. 1352  
(See reverse for public burden disclosure.)

<b>1. Type of Federal Action:</b> <input type="checkbox"/> a. contract <input type="checkbox"/> b. grant <input type="checkbox"/> c. cooperative agreement <input type="checkbox"/> d. loan <input type="checkbox"/> e. loan guarantee <input type="checkbox"/> f. loan insurance		<b>2. Status of Federal Action:</b> <input type="checkbox"/> a. bid/offer/application <input type="checkbox"/> b. initial award <input type="checkbox"/> c. post-award		<b>3. Report Type:</b> <input type="checkbox"/> a. initial filing <input type="checkbox"/> b. material change <b>For Material Change Only:</b> year _____ quarter _____ date of last report _____	
<b>4. Name and Address of Reporting Entity:</b>  <input type="checkbox"/> Prime <input type="checkbox"/> Subawardee Tier _____, if known:   <b>Congressional District, if known:</b>			<b>5. If Reporting Entity in No. 4 is Subawardee, Enter Name and Address of Prime:</b>     <b>Congressional District, if known:</b>		
<b>6. Federal Department/Agency:</b>   			<b>7. Federal Program Name/Description:</b>   <b>CFDA Number, if applicable:</b> _____		
<b>8. Federal Action Number, if known:</b>			<b>9. Award Amount, if known:</b> \$ _____		
<b>10. a. Name and Address of Lobbying Entity</b> <i>(if individual, last name, first name, MI):</i>   			<b>b. Individuals Performing Services</b> <i>(including address if different from No. 10a)</i> <i>(last name, first name, MI):</i>   		
(attach Continuation Sheet(s) SF-LLL-A, if necessary)					
<b>11. Amount of Payment</b> <i>(check all that apply):</i>  \$ _____ <input type="checkbox"/> actual <input type="checkbox"/> planned			<b>13. Type of Payment</b> <i>(check all that apply):</i>  <input type="checkbox"/> a. retainer <input type="checkbox"/> b. one-time fee <input type="checkbox"/> c. commission <input type="checkbox"/> d. contingent fee <input type="checkbox"/> e. deferred <input type="checkbox"/> f. other; specify: _____		
<b>12. Form of Payment</b> <i>(check all that apply):</i>  <input type="checkbox"/> a. cash <input type="checkbox"/> b. in-kind; specify: nature _____ value _____					
<b>14. Brief Description of Services Performed or to be Performed and Date(s) of Service, including officer(s), employee(s), or Member(s) contacted, for Payment indicated in Item 11:</b>           <div style="text-align: right;">(attach Continuation Sheet(s) SF-LLL-A, if necessary)</div>					
<b>15. Continuation Sheet(s) SF-LLL-A attached:</b> <input type="checkbox"/> Yes <input type="checkbox"/> No					
<b>16. Information requested through this form is authorized by title 31 U.S.C section 1352.</b> This disclosure of lobbying activities is a materia representation of fact upon which reliance was placed by the tier above when this transaction was made or entered into. This disclosure is required pursuant to 31 U.S.C. 1352 . This information will be reported to the Congress semi-annually and will be available for public inspection. Any person who fails to file the required disclosure shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.			<b>Signature:</b> _____ <b>Print Name:</b> _____ <b>Title:</b> _____ <b>Telephone No.:</b> _____ <b>Date:</b> _____		
<b>Federal Use Only:</b>				<b>Authorized for Local Reproduction Standard Form - LLL</b>	

## INSTRUCTIONS FOR COMPLETION OF SF-LLL, DISCLOSURE OF LOBBYING ACTIVITIES

This disclosure form shall be completed by the reporting entity, whether subawardee or prime Federal recipient, at the initiation or receipt of a covered Federal action, or a material change to a previous filing, pursuant to title 31 U.S.C. section 1352. The filing of a form is required for each payment or agreement to make payment to any lobbying entity for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a member of Congress in connection with a covered Federal action. Use the SF-LLL-A Continuation Sheet for additional information if the space on the form is inadequate. Complete all items that apply for both the initial filing and material change report. Refer to the implementing guidance published by the Office of Management and Budget for additional information.

1. Identify the type of covered Federal action for which lobbying activity is and/or has been secured to influence the outcome of a covered Federal action.
2. Identify the status of the covered Federal action.
3. Identify the appropriate classification of this report. If this is a followup report caused by a material change to the information previously reported, enter the year and quarter in which the change occurred. Enter the date of the last previously submitted report by this reporting entity for this covered Federal action.
4. Enter the full name, address, city, state and zip code of the reporting entity. Include Congressional District, if known. Check the appropriate classification of the reporting entity that designates if it is, or expects to be, a prime or subaward recipient. Identify the tier of the subawardee, e.g., the first subawardee of the prime is the 1st tier. Subawards include but are not limited to subcontracts, subgrants and contract awards under grants.
5. If the organization filing the report in item 4 checks "Subawardee", then enter the full name, address, city, state and zip code of the prime Federal recipient. Include Congressional District, if known.
6. Enter the name of the Federal agency making the award or loan commitment. Include at least one organizational level below agency name, if known. For example, Department of Transportation, United States Coast Guard.
7. Enter the Federal program name or description for the covered Federal action (item 1). If known, enter the full Catalog of Federal Domestic Assistance (CFDA) number for grants, cooperative agreements, loans, and loan commitments.
8. Enter the most appropriate Federal identifying number available for the Federal action identified in item 1 (e.g., Request for Proposal (RFP) number; Invitation for Bid (IFB) number; grant announcement number; the contract, grant, or loan award number; the application/proposal control number assigned by the Federal agency). Include prefixes, e.g., "RFP-DE-90-001."
9. For a covered Federal action where there has been an award or loan commitment by the Federal agency, enter the Federal amount of the award/loan commitment for the prime entity identified in item 4 or 5.
10. (a) Enter the full name, address, city, state and zip code of the lobbying entity engaged by the reporting entity identified in item 4 to influence the covered Federal action.  
  
(b) Enter the full names of the individuals(s) performing services, and include full address if different from 10 (a). Enter Last Name, First Name, and Middle Initial (MI).
11. Enter the amount of compensation paid or reasonably expected to be paid by the reporting entity (item 4) to the lobbying entity (item 10). Indicate whether the payment has been made (actual) or will be made (planned). Check all boxes that apply. If this is a material change report, enter the cumulative amount of payment made or planned to be made.
12. Check the appropriate box(es). Check all boxes that apply. If payment is made through an in-kind contribution, specify the nature and value of the in-kind payment.
13. Check the appropriate box(es). Check all boxes that apply. If other, specify nature.

Provide a specific and detailed description of the services that the lobbyist has performed, or will be expected to perform, and the date(s) of any services rendered. Include all preparatory and related activity, not just time spent in

Public reporting burden for this collection of information is estimated to average 30 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0046), Washington, D.C. 20503.

**DISCLOSURE OF LOBBYING ACTIVITIES  
CONTINUATION SHEET**

Approved by OM  
0348-0046

Reporting Entity: \_\_\_\_\_ Page \_\_\_\_\_ of \_\_\_\_\_

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## SECTION 00100

### INSTRUCTIONS, CONDITIONS, AND NOTICES TO BIDDERS

#### 1 52.252-1 SOLICITATION PROVISIONS INCORPORATED BY REFERENCE (JUN 1988)

This solicitation incorporates one or more solicitation provisions by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available.

(End of provision)

#### 2 52.0-4200 ISSUING OFFICE

THE ISSUING OFFICE IS THE US ARMY ENGINEER DISTRICT, MOBILE

Delivery Address: 109 St. Joseph St., Federal Building, Room 1000A,  
Mobile, AL 36602

Mailing Address: P.O. Box 2288, Mobile, AL 36628-0001

#### 3 52.0-4202 SUBMITTAL OF OFFER

Proposals in original and 1 copy for the work described herein shall be submitted by 2 p.m. (local time) on or before 22 May 1997 to the issuing office named above. (Proposals delivered by hand must be delivered to the address named above and will not be accepted at any other location.)

Prospective offeror(s) should submit inquiries concerning the mailing of plans and specifications and should address any nontechnical questions by writing or calling (collect calls not accepted) the Plans Room, U.S. Army Engineer District, Mobile, P.O. Box 2288, Mobile, Alabama 36628-0001, Telephone Area Code 334, 690-2535. Technical questions on plans and specifications should be directed to Betty Smith at the same address, telephone Area Code 334, 690-2711.

This solicitation is a "request for proposal" and all references to "bid," "bidder," etc., shall be construed to mean "offer," "proposal," "offeror," etc.

Negotiations will be conducted at the U.S. Army Engineer District Office, 109 St. Joseph Street, Mobile, Alabama.



4 52.0-4214 DESCRIPTION OF WORK

In general, the work shall consist of the following:

The contractor shall design and construct the renovations to Dorm 19, Eglin AFB, Florida. The project site consists of one building with Wings A, B, D and E. Each wing consists of three floors. The dorm will be renovated to the new Air Force one-plus-one standards.

NOTE: The above general outline of features of the work does not in any way limit the responsibility of the Contractor to perform all work and furnish all plant, labor, equipment and materials required by the specifications and the drawings referred to therein.

The cost of this work is estimated to be between \$5,000,000 and \$10,000,000.

5 52.0-4218 CONTRACT AWARD (OCT 1995)--ALT I (OCT 1995) ALT II (OCT 1995)

FAR 52.215-16

(a) The Government will award a contract resulting from this solicitation to the responsible offeror whose offer conforming to the solicitation will be most advantageous to the Government, cost or price and other factors, specified elsewhere in this solicitation, considered.

(b) The Government may (1) reject any or all offers if such action is in the public interest, (2) accept other than the lowest offer, and (3) waive informalities and minor irregularities in offers received.

(c) The Government intends to evaluate proposals and award a contract without discussions with offerors (except communications conducted for the purpose of minor clarification). Therefore, each initial offer should contain the offeror's best terms from a cost or price and technical standpoint. However, the Government reserves the right to conduct discussions if later determined by the Contracting Officer to be necessary.

(d) The Government may accept any item or combination of items, unless doing so is precluded by a restrictive limitation in the solicitation or the offer.

(e) A written award or acceptance of offer mailed or otherwise furnished to the successful offeror within the time for acceptance

specified in the offer shall result in a binding contract without further action by either party. Before the offer's specified expiration time, the Government may accept an offer (or part of an offer, as provided in paragraph (d) above), whether or not there are negotiations after its receipt, unless a written notice of withdrawal is received before award. Negotiations conducted after receipt of an offer do not constitute a rejection or counteroffer by the Government.

(f) Neither financial data submitted with an offer, nor representations concerning facilities or financing, will form a part of the resulting contract. However, if the resulting contract contains a clause providing for price reduction for defective cost or pricing data, the contract price will be subject to reduction if cost or pricing data furnished is incomplete, inaccurate, or not current.

(g) The Government may determine that an offer is unacceptable if the prices proposed are materially unbalanced between line items or subline items. An offer is materially unbalanced when it is based on prices significantly less than cost for some work and prices which are significantly overstated in relation to cost for other work, and if there is a reasonable doubt that the offer will result in the lowest overall cost to the Government, even though it may be the low evaluated offer, or it is so unbalanced as to be tantamount to allowing an advance payment.

(h) The Government may disclose the following information in post-award debriefings to other offerors: (1) the overall evaluated cost or price and technical rating of the successful offeror; (2) the overall ranking of all offerors, when any ranking was developed by the agency during source selection; (3) a summary of the rationale for award and (4) for acquisitions of commercial end items, the make and model of the item to be delivered by the successful offeror.

(End of provision)

Note: The term "item" in paragraph (d) above will be interpreted to mean "Bidding Schedule" for this solicitation.

#### 6 52.0-4065 PRE-AWARD INFORMATION (#3)

(a) Prior to making an award, the Contracting Officer must determine that any offeror eligible for an award is responsible both financially and technically and has the capability to properly manage the contract during performance and complete the work on time.

(b) Accordingly, offerors are required to furnish any necessary data within three (3) calendar days after a request for submittal of preaward data is made. The information requested will be in addition to that required for evaluation in the proposal. (See the paragraph entitled, "Evaluation

Factors for Award", for information to be submitted with the technical and management proposals.)

(c) Any required preaward information may include, but is not limited to the following:

(1) A copy of offeror's latest financial statement including the names of banks or other financial institutions with which the offeror conducts business. If the financial statement is more than 60 days old, a certificate must be attached stating that the financial condition is substantially the same, or if not the same, the changes that have taken place. Such statement will be treated as confidential.

(2) A list of present commitments, including the dollar value thereof, and name of the organization under which the work is being performed. Include names and telephone numbers of personnel within each organization who are familiar with the prospective contractor's performance.

(3) If the bid exceeds \$1,000,000.00, the offeror shall also submit with his offer, or within the three (3) days as specified above for submission of other preaward information, a certified statement listing:

a. Each contract awarded to him within the preceding three month period exceeding \$1,000,000.00 in value with brief description of the contract.

b. Each contract awarded to him within the preceding three year period not already physically completed and exceeding \$5,000,000.00 in value with brief description of the contract.

c. If the prospective contractor is a joint venture, each joint venture member will be required to submit the above defined certification.

d. If the prospective contractor is a large business concern, he must submit a subcontracting plan in compliance with the contract clause, SMALL BUSINESS AND SMALL DISADVANTAGED BUSINESS SUBCONTRACTING PLAN.

(d) All requests for submittal of preaward data or clarification of data submitted will be made by telephone and the offeror agrees to prepare and transmit the data requested within the required timeframe. Each offeror is urged to submit the specified information with the proposal to avoid delay and cost incidental to obtaining such data after the proposals have been received.

## 7 52.0-4235 CONTRACT PRICES - BIDDING SCHEDULE

Payment for the various items listed in the Bidding Schedule shall constitute full compensation for furnishing all plant, labor, equipment, appliances, materials and bonds (performance and payment), and for performing all operations required to complete the work in conformity with the drawings and specifications. All costs for work not specifically mentioned in the Bidding Schedule shall be included in the contract prices

for the items listed.

8 52.0-4026 ARITHMETIC DISCREPANCIES (MAR 1995) EFARS 52.214-5000

(a) For the purpose of initial evaluation of bids, the following will be utilized in resolving arithmetic discrepancies found on the face of the bidding schedule as submitted by bidders:

- (1) Obviously misplaced decimal points will be corrected;
- (2) In case of discrepancy between unit price and extended price, the unit price will govern;
- (3) Apparent errors in extension of unit prices will be corrected; and
- (4) Apparent errors in addition of lump-sum and extended prices will be corrected.

(b) For the purpose of bid evaluation, the Government will proceed on the assumption that the bidder intends his bid to be evaluated on the basis of unit prices, extensions, and totals arrived at by resolution of arithmetic discrepancies as provided above and the bid will be so reflected on the abstract of bids.

9 52.0-4236 SOURCE LIST FOR SMALL DISADVANTAGED SUBCONTRACTORS

Bidders desiring assistance in developing a source list of small disadvantaged subcontractors are encouraged to contact small disadvantaged contractor associations and appropriate offices of Minority Business Development Agency, addresses of which may be obtained from the U.S. Army Engineer District, Mobile, ATTN: CESAM-DB, P.O. Box 2288, Mobile, Alabama 36628.

10 52.0-4241 MANUALS AND PUBLICATIONS

Engineering manuals and Concrete Research Division Publications may be obtained from the addresses given below.

Engineering Manuals: U. S. Army, Corps of Engineers

Publications Depot  
2803 - 52nd Avenue  
Hyattsville, MD 20781-1102

Concrete Research Division Publications:

U.S. Army Engineer Waterways Experiment Station  
ATTN: Publications Distribution Unit  
P.O. Box 631

Vicksburg, MS 39180

11 52.0-4242 SAFETY REQUIREMENTS

a. The bidder should review the accident prevention clause of the contract, the U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, and all changes and amendments thereto, (copies available upon request), and the latest OSHA standards, to assure himself that he has full knowledge of the personal protective equipment that must be provided workmen and that he is familiar with the safety standards applicable during this project. The Contractor's shall comply with all applicable provisions.

b. In those cases where it is determined that contract safety requirements are not being met, the contracting officer has many options to assure compliance for a safe operation. For imminent danger situations in which the life of a worker is immediately threatened, work in the area affected by the violation will be stopped immediately until the condition is corrected. For non-correction of serious hazards (not immediately life threatening) the contracting officer may retain progress payments, or portions thereof, per the "Payments under Fixed-Price Construction Contracts" clause, or may require the Contractor to remove supervisors or employees per the "Material and Workmanship" clause. Chronic recurrence of serious safety violations may result in termination of the contract in accordance with the "Default (Fixed-Price Construction)" clause.

12 52.0-4243 EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE

a. Whenever a contract or modification of contract price is negotiated, the contractor's cost proposals for equipment ownership and operating expenses shall be determined in accordance with the requirements of the paragraph entitled "EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE," contained in the Special Clause section of the Specifications. A copy of EP 1110-1-8 "Construction Equipment Ownership and Operating Expense Schedule" is available for review at United States Army Engineer District, Mobile, Federal Building, Room 1000A, 109 St. Joseph Street, Mobile, Alabama, and at all Corps of Engineers field offices.

b. A copy of EP 1110-1-8 is available for purchase at a cost of \$28.00 per volume from the following locations:

Government Printing office Telephone: A/C 202 512-1800

P. O. Box 371954

Pittsburgh, PA 15250-7954

The following locations sell only Volume III (Region III-Southeastern U.S.):

Government Book Store Telephone: A/C 904 353-0472

100 West Bay Street, Suite 100

Jacksonville, Florida 32202

Government Book Store Telephone: A/C 205 731-1056

2021 3rd Avenue North

Birmingham, Alabama 35203

Government Book Store Telephone: A/C 404 347-1900

999 Peachtree St., N.E., Suite 120

Atlanta, Georgia 30343

U.S. Government Printing Office Telephone: A/C 301 953-7974

Document Warehouse

8660 Cherry Lane

Laurel, MD 20707

When ordering, please specify the volume or region number plus the Stock Number 008-022-00299-5.

Delivery will not be made until Check/Payment is in hand; or, telephone requests will be honored using Mastercard or Visa Credit Cards. Checks are to be made out to the Superintendent of Documents.

13 52.204-7001 COMMERCIAL AND GOVERNMENT ENTITY (CAGE) CODE REPORTING (DEC 1991)

(a) The Offeror is requested to enter its CAGE code on its offer in the block with its name and address. The CAGE code entered must be for that name and address. Enter CAGE before the number.

(b) If the Offeror does not have a CAGE code, it may ask the Contracting Officer to request one from the Defense Logistics Services Center (DLSC).

The Contracting Officer will--

(1) Ask the Contractor to complete section B of a DD Form 2051, Request for Assignment of a Commercial and Government Entity (CAGE) Code;

(2) Complete section A and forward the form to DLSC; and

(3) Notify the Contractor of its assigned CAGE code.

(c) Do not delay submission of the offer pending receipt of a CAGE code.

(End of provision)

14 52.211-2 AVAILABILITY OF SPECIFICATIONS LISTED IN THE DOD INDEX OF SPECIFICATIONS AND STANDARDS (DODISS) (MAR 1994)

Single copies of specifications cited in this solicitation may be obtained by submitting a written request to the supply point listed below.

The request must contain the title of the specification, its number, date,

applicable amendment(s), and the solicitation or contract number. A telephone order entry system is available with the use of a touch tone telephone. A Customer Number is required to use this system and may be obtained by written request to the address listed below or by telephone (215-697-2179). In case of urgency, telegraphic requests are acceptable. Voluntary standards, which are not available to Offerors and Contractors from Government sources, may be obtained from the organization responsible for their preparation, maintenance, or publication.

Standardization Document

Order Desk, Building 4, Section D

700 Robbins Avenue

Philadelphia, PA 19111-5094

Facsimile No.....215-697-2978

Telephone Order Entry System (TOES) Numbers.....215-697-1187 through and including 215-697-1197

(End of provision)

15 52.211-14 NOTICE OF PRIORITY RATING FOR NATIONAL DEFENSE USE (SEP 1990)

Any contract awarded as a result of this solicitation will be / / DX rated order; /XX/ DO rated order certified for national defense use under the Defense Priorities and Allocations System (DPAS) (15 CFR 700), and the Contractor will be required to follow all of the requirements of this regulation.

(End of provision)

16 52.215-5 SOLICITATION DEFINITIONS (JUL 1987)

"Government" means United States Government.

"Offer" means "proposal" in negotiation.

"Solicitation" means a request for proposals (RFP) or a request for quotations (RFQ) in negotiation.

(End of provision)

17 52.215-7 UNNECESSARILY ELABORATE PROPOSALS OR QUOTATIONS (APR 1984)

Unnecessarily elaborate brochures or other presentations beyond those sufficient to present a complete and effective response to this solicitation are not desired and may be construed as an indication of the offeror's or quoter's lack of cost consciousness. Elaborate art work,

expensive paper and bindings, and expensive visual and other presentation aids are neither necessary nor wanted.

(End of provision)

(AV 7-2003.40 1969 OCT)

18 52.215-8 AMENDMENTS TO SOLICITATIONS (DEC 1989)

(a) If this solicitation is amended, then all terms and conditions which are not modified remain unchanged.

(b) Offerors shall acknowledge receipt of any amendment to this solicitation by (1) signing and returning the amendment, (2) identifying the amendment number and date in the space provided for this purpose on the form for submitting an offer, (3) letter or telegram, or (4) facsimile, if facsimile offers are authorized in the solicitation. The Government must receive the acknowledgment by the time specified for receipt of offers.

(End of provision)

19 52.215-9 SUBMISSION OF OFFERS (JUL 1995)

(a) Offers and modifications thereof shall be submitted in sealed envelopes or packages (1) addressed to the office specified in the solicitation, and (2) showing the time specified for receipt, the solicitation number, and the name and address of the offeror.

(b) Telegraphic offers will not be considered unless authorized by the solicitation; however, offers may be modified by written or telegraphic notice.

(c) Facsimile offers, modifications or withdrawals will not be considered unless authorized by the solicitation.

(d) Offers submitted by electronic commerce shall be considered only if the electronic commerce method was specifically stipulated or permitted by the solicitation.

(e) Item samples, if required, must be submitted within the time specified for receipt of offers. Unless otherwise specified in the solicitation, these samples shall be (1) submitted at no expense to the Government, and (2) returned at the sender's request and expense, unless they are destroyed during preaward testing.

(End of provision)



(a) Any proposal received at the office designated in the solicitation after the exact time specified for receipt will not be considered unless it is received before award is made and it--

(1) Was sent by registered or certified mail not later than the fifth calendar day before the date specified for receipt of offers (e.g., an offer submitted in response to a solicitation requiring receipt of offers by the 20th of the month must have been mailed by the 15th);

(2) Was sent by mail or, if authorized by the solicitation, was sent by telegram or via facsimile and it is determined by the Government that the late receipt was due solely to mishandling by the Government after receipt at the Government installation;

(3) Was sent by U.S. Postal Service Express Mail Next Day Service-Post Office to Addressee, not later than 5:00 p.m. at the place of mailing two working days prior to the date specified for receipt of proposals. The term "working days" excludes weekends and U.S. Federal holidays;

(4) Was transmitted through an electronic commerce method authorized by the solicitation and was received by the Government not later than 5:00 p.m. one working day prior to the date specified for receipt of proposals; or

(5) Is the only proposal received.

(b) Any modification of a proposal or quotation, except a modification resulting from the Contracting Officer's request for "best and final" offer, is subject to the same conditions as in subparagraphs (a)(1), (2), and (3) of this provision.

(c) A modification resulting from the Contracting Officer's request for "best and final" offer received after the time and date specified in the request will not be considered unless received before award and the late receipt is due solely to mishandling by the Government after receipt at the Government installation.

(d) The only acceptable evidence to establish the date of mailing of a late proposal or modification sent either by U.S. Postal Service registered or certified mail is the U.S. or Canadian Postal Service postmark both on the envelope or wrapper and on the original receipt from the U.S. or Canadian Postal Service. Both postmarks must show a legible date or the proposal, quotation, or modification shall be processed as if mailed late. "Postmark" means a printed, stamped, or otherwise placed impression (exclusive of a postage meter machine impression) that is readily identifiable without further action as having been supplied and affixed by employees of the U.S. or Canadian Postal Service on the date of mailing. Therefore, offerors or quoters should request the postal clerk to place a legible hand cancellation bull's eye postmark on both the receipt and the

envelope or wrapper.

(e) The only acceptable evidence to establish the time of receipt at the Government installation is the time/date stamp of that installation on the proposal wrapper or other documentary evidence of receipt maintained by the installation.

(f) The only acceptable evidence to establish the date of mailing of a late offer, modification, or withdrawal sent by Express Mail Next Day Service-Post Office to Addressee is the date entered by the post office receiving clerk on the "Express Mail Next Day Service-Post Office to Addressee" label and the postmark on both the envelope or wrapper and on the original receipt from the U.S. Postal Service. "Postmark" has the same meaning as defined in paragraph (d) of this provision, excluding postmarks of the Canadian Postal Service. Therefore, offerors or quoters should request the postal clerk to place a legible hand cancellation bull's eye postmark on both the receipt and the envelope or wrapper.

(g) Notwithstanding paragraph (a) of this provision, a late modification of an otherwise successful proposal that makes its terms more favorable to the Government will be considered at any time it is received and may be accepted.

(h) Proposals may be withdrawn by written notice or telegram (including mailgram) received at any time before award. If the solicitation authorizes facsimile proposals, proposals may be withdrawn via facsimile received at any time before award, subject to the conditions specified in the provision entitled "Facsimile Proposals." Proposals may be withdrawn in person by an offeror or an authorized representative, if the representative's identity is made known and the representative signs a receipt for the proposal before award.

(i) If an emergency or unanticipated event interrupts normal Government processes so that proposals cannot be received at the office designated for receipt of proposals by the exact time specified in the solicitation, and urgent Government requirements preclude amendment of the solicitation or other notice of an extension of the closing date, the time specified for receipt of proposals will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which normal Government processes resume. If no time is specified in the solicitation, the time for receipt is 4:30 p.m., local time, for the designated Government office.

(End of provision)

21 52.215-12 RESTRICTION ON DISCLOSURE AND USE OF DATA (APR 1984)

Offerors or quoters who include in their proposals or quotations data

that they do not want disclosed to the public for any purpose or used by the Government except for evaluation purposes, shall--

(a) Mark the title page with the following legend:

"This proposal or quotation includes data that shall not be disclosed outside the Government and shall not be duplicated, used, or disclosed--in whole or in part--for any purpose other than to evaluate this proposal or quotation. If, however, a contract is awarded to this offeror or quoter as a result of--or in connection with--the submission of this data, the Government shall have the right to duplicate, use, or disclose the data to the extent provided in the resulting contract. This restriction does not limit the Government's right to use information contained in this data if it is obtained from another source without restriction. The data subject to this restriction are contained in sheets [insert numbers or other identification of sheets];" and

(b) Mark each sheet of data it wishes to restrict with the following legend:

"Use or disclosure of data contained on this sheet is subject to the restriction on the title page of this proposal or quotation."

(End of provision)

(R 3-501(b) Sec L (xxiv))

## 22 52.215-14 EXPLANATION TO PROSPECTIVE OFFERORS (APR 1984)

Any prospective offeror desiring an explanation or interpretation of the solicitation, drawings, specifications, etc., must request it in writing soon enough to allow a reply to reach all prospective offerors before the submission of their offers. Oral explanations or instructions given before the award of the contract will not be binding. Any information given to a prospective offeror concerning a solicitation will be furnished promptly to all other prospective offerors as an amendment of the solicitation, if that information is necessary in submitting offers or if the lack of it would be prejudicial to any other prospective offerors.

(End of provision)

(R SF 33A, Para 3, 1978 JAN)

## 23 52.215-38 PREPARATION OF OFFERS--CONSTRUCTION (JAN 1991)

(a) Offers must be (1) submitted on the forms furnished by the Government or on copies of those forms, and (2) manually signed. The person signing an offer must initial each erasure or change appearing on any offer form.

(b) The offer form may require Offerors to submit offer prices for one or more items on various bases, including--

- (1) Lump sum offer;
- (2) Alternate prices;
- (3) Units of construction; or
- (4) Any combination of subparagraphs (b)(1) through (b)(3) of this provision.

(c) If the solicitation requires an offer on all items, failure to do so will disqualify the offer. If an offer on all items is not required, Offerors should insert the words "no offer" in the space provided for any item on which no price is submitted.

(d) Alternate offers will not be considered unless this solicitation authorizes their submission.

(End of provision)

24 52.222-23 NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT

OPPORTUNITY (APR 1984)

(a) The offeror's attention is called to the Equal Opportunity clause and the Affirmative Action Compliance Requirements for Construction clause of this solicitation.

(b) The goals for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

----- -----	
Goals for minority participation	Goals for female participation for
for each trade	each trade
----- -----	
15.4%	6.9%
----- -----	

These goals are applicable to all the Contractor's construction work performed in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, the Contractor shall apply the goals established for the geographical area where the work is actually performed. Goals are published periodically in the Federal Register in notice form, and these notices may be obtained from any Office of Federal Contract Compliance Programs office.

(c) The Contractor's compliance with Executive Order 11246, as amended, and the regulations in 41 CFR 60-4 shall be based on (1) its implementation of the Equal Opportunity clause, (2) specific affirmative

action obligations required by the clause entitled "Affirmative Action Compliance Requirements for Construction," and (3) its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade. The Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor, or from project to project, for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, Executive Order 11246, as amended, and the regulations in 41 CFR 60-4. Compliance with the goals will be measured against the total work hours performed.

(d) The Contractor shall provide written notification to the Director, Office of Federal Contract Compliance Programs, within 10 working days following award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the--

- (1) Name, address, and telephone number of the subcontractor;
- (2) Employer's identification number of the subcontractor;
- (3) Estimated dollar amount of the subcontract;
- (4) Estimated starting and completion dates of the subcontract; and
- (5) Geographical area in which the subcontract is to be performed.

(e) As used in this Notice, and in any contract resulting from this solicitation, the "covered area" is Okaloosa County, Florida (Design and Construction of Renovate Dormitory 19, Eglin Air Force Base, Florida).

(End of provision)

(R 7-2003.14(d) 1978 SEP)

## 25 52.228-11 PLEDGES OF ASSETS (FEB 1992)

(a) Offerors shall obtain from each person acting as an individual surety on a bid guarantee, a performance bond, or a payment bond--

- (1) Pledge of assets; and
- (2) Standard Form 28, Affidavit of Individual Surety.

(b) Pledges of assets from each person acting as an individual surety shall be in the form of--

- (1) Evidence of an escrow account containing cash, certificates of deposit, commercial or Government securities, or other assets described in FAR 28.203-2 (except see 28.203-2(b)(2) with respect to Government securities held in book entry form) and/or;
- (2) A recorded lien on real estate. The offeror will be required to provide--

- (i) Evidence of title in the form of a certificate of title prepared

by a title insurance company approved by the United States Department of Justice. This title evidence must show fee simple title vested in the surety along with any concurrent owners; whether any real estate taxes are due and payable; and any recorded encumbrances against the property, including the lien filed in favor of the Government as required by FAR 28.203-3(d);

(ii) Evidence of the amount due under any encumbrance shown in the evidence of title;

(iii) A copy of the current real estate tax assessment of the property or a current appraisal dated no earlier than 6 months prior to the date of the bond, prepared by a professional appraiser who certifies that the appraisal has been conducted in accordance with the generally accepted appraisal standards as reflected in the Uniform Standards of Professional Appraisal Practice, as promulgated by the Appraisal Foundation.

(End of clause)

26 52.232-18 AVAILABILITY OF FUNDS (APR 1984)

Funds are not presently available for this contract. The Government's obligation under this contract is contingent upon the availability of appropriated funds from which payment for contract purposes can be made. No legal liability on the part of the Government for any payment may arise until funds are made available to the Contracting Officer for this contract and until the Contractor receives notice of such availability, to be confirmed in writing by the Contracting Officer.

(End of clause)

(SS 7-104.91(a) 1962 SEP)

27 52.9999-4013 SERVICE OF PROTEST (AUG 1996) FAR 52.233-2

(a) Protests, as defined in section 33.101 of the Federal Acquisition Regulation, that are filed directly with an agency, and copies of any protests that are filed with the General Accounting Office (GAO), shall be served on the Contracting Officer (addressed as follows) by obtaining written and dated acknowledgment of receipt from the U. S. Army Engineer District, Mobile, P. O. Box 2288, Mobile, AL 36628-0001.

(b) The copy of any protest shall be received in the office designated above within one day of filing a protest with the GAO.

28 52.0-4216 ORDERING OF SPECIFICATIONS AND DRAWINGS

Copies of specifications and drawings for this solicitation will be available on CD-ROM only. The CD-ROM will be available at no charge and should not be returned to the Mobile District. Requests for solicitations should be addressed to the U.S. Army Engineer District, Mobile, 109 St. Joseph Street, Mobile, Alabama 36602 or P.O. Box 2288, Mobile, Alabama 36628-0001 or FAX A/C 334, 694-4343, Attn: Karen L. Johnson or Mary H. Browder. Telephonic requests will not be accepted. A firm's physical address, telephone and facsimile numbers, and name of point of contact must also be provided to facilitate any overnight mailing.

Requests for copies of this solicitation on CD-ROM will be furnished on a "first come-first served" basis only so long as the initial supply is available. The CD-ROM will not be available after the bid opening date.

29 52.0-4220 JOINT VENTURE BID REQUIREMENTS

When bidding as a joint venture, all members of the joint venture must sign the SF 1442, the bid bond, and the Certificate of Procurement Integrity unless a written agreement by the joint venture is furnished with the bid designating one firm with the authority to bind the other member(s) of the joint venture. In addition, a copy of the joint venture agreement must be submitted with the bid. Failure to comply with the foregoing requirements may render the bid as non-responsive.

30 52.0-4234 BID GUARANTEE (SEP 1996) FAR 52.228-1

(a) Failure to furnish a bid guarantee in the proper form and amount, by the time set for opening of bids, may be cause for rejection of the bid.

(b) The bidder shall furnish a bid guarantee in the form of a firm commitment, e.g., bid bond supported by good and sufficient surety or sureties acceptable to the Government, postal money order, certified check, cashier's check, irrevocable letter of credit, or, under Treasury Department regulations, certain bonds or notes of the United States. The Contracting Officer will return bid guarantees, other than bid bonds, (1) to unsuccessful bidders as soon as practicable after the opening of bids, and (2) to the successful bidder upon execution of contractual documents and bonds (including any necessary coinsurance or reinsurance agreements), as required by the bid as accepted.

(c) The amount of the bid guarantee shall be twenty percent of the bid

price or \$3,000,000, whichever is less.

(d) If the successful bidder, upon acceptance of its bid by the Government within the period specified for acceptance, fails to execute all contractual documents or furnish executed bond(s) within 10 days after receipt of the forms by the bidder, the Contracting Officer may terminate the contract for default.

(e) In the event the contract is terminated for default, the bidder is liable for any cost of acquiring the work that exceeds the amount of its bid, and the bid guarantee is available to offset the difference.

(End of provision)

END OF SECTION 00100



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SECTION 00600

REPRESENTATIONS & CERTIFICATIONS

1 52.0-4010 AFFILIATED BIDDERS (APR 1984) FAR 52.214-17

(a) Business concerns are affiliates of each other when, either directly or indirectly, (1) one concern controls or has the power to control the other, or (2) a third party controls or has the power to control both.

(b) Each bidder shall submit with its bid an affidavit stating that it has no affiliates, or containing the following information.

(1) The names and addresses of all affiliates of the bidder.

(2) The names and addresses of all persons and concerns exercising control or ownership of the bidder and any or all of its affiliates, and whether they exercise such control or ownership as common officers, directors, stockholders, holding controlling interest, or otherwise.

Please check when applicable:

\_\_\_\_\_ The offeror certifies that it has no affiliates.

\_\_\_\_\_ The offeror certifies that it is affiliated with the concerns designated on an attached affidavit.

2 52.0-4011 DUN AND BRADSTREET DATA UNIVERSAL NUMBERING SYSTEM (DUNS)

The offeror's DUNS number is \_\_\_\_\_.

The DUNS number is a 9-digit number assigned to a contractor establishment by Dun and Bradstreet. The Duns and Bradstreet Data Universal Numbering System (DUNS) is a contractor identification coding system which has now replaced the Contractor Establishment Code (CEC). If your company does not have its DUNS number, please contact this agency and we will obtain one for you.

(End of provision)

3 52.0-4162 COMMERCIAL AND GOVERNMENT ENTITY (CAGE) CODE

The offeror's Commercial and Government Entity (CAGE) Code is \_\_\_\_\_.

If the offeror does not have a CAGE code, the offeror may request the Contracting Officer to initiate a DD Form 2051. The Contracting Activity will complete Section A and the offeror must complete Section B of the DD Form 2051. A CAGE code will be assigned when a completed DD Form 2051 is received by the Defense Logistics Services Center, Attn: DLSC-FBA, Federal Center, 74 N. Washington, Battle Creek, MI 49027-3084. No offeror should delay the submission of its offer pending receipt of its CAGE code.

4 52.203-2 CERTIFICATE OF INDEPENDENT PRICE DETERMINATION (APR 1985)

(a) The offeror certifies that--

(1) The prices in this offer have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other offeror or competitor relating to (i) those prices, (ii) the intention to submit an offer, or (iii) the

methods or factors used to calculate the prices offered;

(2) The prices in this offer have not been and will not be knowingly disclosed by the offeror, directly or indirectly, to any other offeror or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a negotiated solicitation) unless otherwise required by law; and

(3) No attempt has been made or will be made by the offeror to induce any other concern to submit or not to submit an offer for the purpose of restricting competition.

(b) Each signature on the offer is considered to be a certification by the signatory that the signatory--

(1) Is the person in the offeror's organization responsible for determining the prices being offered in this bid or proposal, and that the signatory has not participated and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) above; or

(2)(i) Has been authorized, in writing, to act as agent for the following principals in certifying that those principals have not participated, and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) above \_\_\_\_\_

---

(insert full name of person(s) in the offeror's organization responsible for determining the prices offered in this bid or proposal, and the title of his or her position in the offeror's organization);

(ii) As an authorized agent, does certify that the principals named in subdivision (b)(2)(i) above have not participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) above; and

(iii) As an agent, has not personally participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) above.

(c) If the offeror deletes or modifies subparagraph (a)(2) above, the offeror must furnish with its offer a signed statement setting forth in detail the circumstances of the disclosure.

(End of provision)

## 5 52.203-11 CERTIFICATION AND DISCLOSURE REGARDING PAYMENTS TO INFLUENCE CERTAIN

### FEDERAL TRANSACTIONS (APR 1991)

(a) The definitions and prohibitions contained in the clause, at FAR 52.203-12, Limitation on Payments to Influence Certain Federal Transactions, included in this solicitation, are hereby incorporated by reference in paragraph (b) of this certification.

(b) The offeror, by signing its offer, hereby certifies to the best of his or her knowledge and belief that on or after December 23, 1989,--

(1) No Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment or modification of any Federal contract, grant, loan, or cooperative agreement;

(2) If any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with this solicitation, the offeror shall complete and submit, with its offer, OMB standard form LLL, Disclosure of Lobbying Activities, to the Contracting Officer; and

(3) He or she will include the language of this certification in all subcontract awards at any tier and require that all recipients of subcontract awards in excess of \$100,000 shall certify and disclose accordingly.

(c) Submission of this certification and disclosure is a prerequisite for making or entering into this contract imposed by section 1352, title 31, United States Code. Any person who makes an expenditure prohibited under this provision or who fails to file or amend the disclosure form to be filed or amended by this provision, shall be subject to a civil penalty of not less than \$10,000, and not more than \$100,000, for each such failure.

(End of provision)

#### 6 52.204-3 TAXPAYER IDENTIFICATION (MAR 1994)

##### (a) Definitions.

"Common parent," as used in this solicitation provision, means that corporate entity that owns or controls an affiliated group of corporations that files its Federal income tax returns on a consolidated basis, and of which the offeror is a member.

"Corporate status," as used in this solicitation provision, means a designation as to whether the offeror is a corporate entity, an unincorporated entity (e.g., sole proprietorship or partnership), or a corporation providing medical and health care services.

"Taxpayer Identification Number (TIN)," as used in this solicitation provision, means the number required by the IRS to be used by the offeror in reporting income tax and other returns.

(b) All offerors are required to submit the information required in paragraphs (c) through (e) of this solicitation provision in order to comply with reporting requirements of 26 U.S.C. 6041, 6041A, and 6050M and implementing regulations issued by the Internal Revenue Service (IRS). If the resulting contract is subject to the reporting requirements described in FAR 4.903, the failure or refusal by the offeror to furnish the information may result in a 31 percent reduction of payments otherwise due under the contract.

##### (c) Taxpayer Identification Number (TIN).

☐ TIN: \_\_\_\_\_.

☐ TIN has been applied for.

☐ TIN is not required because:

☐ Offeror is a nonresident alien, foreign corporation, or foreign partnership that does not have income effectively connected with the conduct of a trade or business in the U.S. and does not have an office or place of business or a fiscal paying agent in the U.S.;

☐ Offeror is an agency or instrumentality of a foreign government;

☐ Offeror is an agency or instrumentality of a Federal, state, or local government;

☐ Other. State basis. \_\_\_\_\_

(d) Corporate Status.

☐ Corporation providing medical and health care services, or engaged in the billing and collecting of payments for such services;

☐ Other corporate entity;

☐ Not a corporate entity;

☐ Sole proprietorship

☐ Partnership

☐ Hospital or extended care facility described in 26 CFR 501(c)(3) that is exempt from taxation under 26 CFR 501(a).

(e) Common Parent.

☐ Offeror is not owned or controlled by a common parent as defined in paragraph (a) of this clause.

☐ Name and TIN of common parent:

Name \_\_\_\_\_

TIN \_\_\_\_\_

(End of provision)

7 52.209-5 CERTIFICATION REGARDING DEBARMENT, SUSPENSION, PROPOSED DEBARMENT, AND OTHER RESPONSIBILITY MATTERS (MAR 1996)

(a)(1) The Offeror certifies, to the best of its knowledge and belief, that--

(i) The Offeror and/or any of its Principals--

(A) Are // are not // presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any Federal agency;

(B) Have // have not //, within a three-year period preceding this offer, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, state, or local) contract or subcontract; violation of Federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, or receiving stolen property; and

(C) Are // are not // presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in subdivision (a)(1)(i)(B) of this provision.

(ii) The Offeror has // has not //, within a three-year period preceding this offer, had one or more contracts terminated for default by any Federal agency.

(2) "Principals," for the purposes of this certification, means officers; directors; owners; partners; and, persons having primary management or supervisory responsibilities within a business entity (e.g., general manager; plant manager; head of a subsidiary, division, or business segment, and similar positions).

THIS CERTIFICATION CONCERNS A MATTER WITHIN THE JURISDICTION OF AN AGENCY OF THE UNITED STATES AND THE MAKING OF A FALSE, FICTITIOUS, OR FRAUDULENT CERTIFICATION MAY RENDER THE MAKER SUBJECT TO PROSECUTION UNDER SECTION 1001, TITLE 18, UNITED STATES CODE.

(b) The Offeror shall provide immediate written notice to the Contracting Officer if, at any time prior to contract award, the Offeror learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

(c) A certification that any of the items in paragraph (a) of this provision exists will not necessarily result in withholding of an award under this solicitation. However, the certification will be considered in connection with a determination of the Offeror's responsibility. Failure of the Offeror to furnish a certification or provide such additional information as requested by the Contracting Officer may render the Offeror nonresponsible.

(d) Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by paragraph (a) of this provision. The knowledge and information of an Offeror is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

(e) The certification in paragraph (a) of this provision is a material representation of fact upon which reliance was placed when making award. If it is later determined that the Offeror knowingly rendered an erroneous certification, in addition to other remedies available to the Government, the Contracting Officer may terminate the contract resulting from this solicitation for default.

(End of provision)

#### 8 52.209-7001 DISCLOSURE OF OWNERSHIP OR CONTROL BY THE GOVERNMENT OF A TERRORIST COUNTRY (SEP 1994)

##### (a) Definitions.

As used in this provision--

(1) "Government of a terrorist country" includes the state and the government of a terrorist country, as well as any political subdivision, agency, or instrumentality thereof.

(2) "Terrorist country" means a country determined by the Secretary of State, under section 6(j)(1)(A) of the Export Administration Act of 1979 (50 U.S.C. App. 2405(j)(1)(A)), to be a country the government of which has repeatedly provided support for acts of international terrorism. As of the date of this provision, terrorist countries include: Cuba, Iran, Iraq, Libya, North Korea, Sudan, and Syria.

(3) "Significant interest" means--

(i) Ownership of or beneficial interest in 5 percent or more of the firm's or subsidiary's securities. Beneficial interest includes holding 5 percent or more of any class of the firm's securities in "nominee shares," "street names," or some other method of holding securities that does not disclose the beneficial owner;

(ii) Holding a management position in the firm, such as a director or officer;

(iii) Ability to control or influence the election, appointment, or tenure of directors or officers in the firm;

(iv) Ownership of 10 percent or more of the assets of a firm such as equipment, buildings, real estate, or other tangible assets of the firm; or

(v) Holding 50 percent or more of the indebtedness of a firm.

##### (b) Prohibition on award.

In accordance with 10 U.S.C. 2327, no contract may be awarded to a firm or a subsidiary of a firm if the government of a terrorist country has a significant interest in the firm or subsidiary, unless a waiver is granted by the Secretary of Defense.

##### (c) Disclosure.

If the government of a terrorist country has a significant interest in the Offeror or a subsidiary of the Offeror, the Offeror shall disclose such interest in an attachment to its offer. If the Offeror is a subsidiary, it shall also disclose any significant interest the government of a terrorist country has in any firm that owns or controls the subsidiary. The disclosure shall include--

- (1) Identification of each government holding a significant interest;
  - and
  - (2) A description of the significant interest held by each government.
- (End of provision)

9 52.214-4 FALSE STATEMENTS IN BIDS (APR 1984)

Bidders must provide full, accurate, and complete information as required by this solicitation and its attachments. The penalty for making false statements in bids is prescribed in 18 U.S.C. 1001.

(End of provision)  
(R 2-201(b)(xiii))  
(R 1-2.201(a)(11))

10 52.215-6 TYPE OF BUSINESS ORGANIZATION (JUL 1987)

The offeror or quoter, by checking the applicable box, represents that--

(a) It operates as ☐ a corporation incorporated under the laws of the State of \_\_\_\_\_, ☐ an individual, ☐ a partnership, ☐ a nonprofit organization, or ☐ a joint venture.

(b) If the offeror or quoter is a foreign entity, it operates as ☐ an individual, ☐ a partnership, ☐ a nonprofit organization, ☐ a joint venture, or ☐ a corporation, registered for business in

\_\_\_\_\_  
(country).

(End of provision)

11 52.215-11 AUTHORIZED NEGOTIATORS (APR 1984)

The offeror or quoter represents that the following persons are authorized to negotiate on its behalf with the Government in connection with this request for proposals or quotations:

Name	Title	Telephone number
_____	_____	_____
_____	_____	_____
_____	_____	_____

[list names, titles, and telephone numbers of the authorized negotiators].

(End of provision)  
(R 3-501(b) Sec K (iv))

12 52.219-1 SMALL BUSINESS PROGRAM REPRESENTATIONS (JAN 1997)

(a)(1) The standard industrial classification (SIC) code for this acquisition is 1522

(2) The small business size standard is \$17,000,000.

(3) The small business size standard for a concern which submits an

offer in its own name, other than on a construction or service contract, but which proposes to furnish a product which it did not itself manufacture, is 500 employees.

(b) Representations. (1) The offeror represents as part of its offer that it [ ] is, [ ] is not a small business concern.

(2) (Complete only if offeror represented itself as a small business concern in block (b)(1) of this section.) The offeror represents as part of its offer that it [ ] is, [ ] is not a small disadvantaged business concern.

(3) (Complete only if offeror represented itself as a small business concern in block (b)(1) of this section.) The offeror represents as part of its offer that it [ ] is, [ ] is not a women-owned small business concern.

(c) Definitions. "Joint venture," for purposes of a small disadvantaged business (SDB) set-aside or price evaluation preference (as prescribed at 13 CFR 124.321), is a concern that is owned and controlled by one or more socially and economically disadvantaged individuals entering into a joint venture agreement with one or more business concerns and is considered to be affiliated for size purposes with such other concern(s). The combined annual receipts or employees of the concerns entering into the joint venture must meet the applicable size standard corresponding to the SIC code designated for the contract. The majority of the venture's earnings must accrue directly to the socially and economically disadvantaged individuals in the SDB concern(s) in the joint venture. The percentage of the ownership involvement in a joint venture by disadvantaged individuals must be at least 51 percent.

"Small business concern," as used in this provision, means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria in 13 CFR Part 121 and the size standard in paragraph (a) of this provision.

"Small disadvantaged business concern," as used in this provision, means a small business concern that (1) is at least 51 percent unconditionally owned by one or more individuals who are both socially and economically disadvantaged, or a publicly owned business having at least 51 percent of its stock unconditionally owned by one or more socially and economically disadvantaged individuals, and (2) has its management and daily business controlled by one or more such individuals. This term also means a small business concern that is at least 51 percent unconditionally owned by an economically disadvantaged Indian tribe or Native Hawaiian Organization, or a publicly owned business having at least 51 percent of its stock unconditionally owned by one or more of these entities, which has its management and daily business controlled by members of an economically disadvantaged Indian tribe or Native Hawaiian Organization, and which meets the requirements of 13 CFR Part 124.

"Women-owned small business concern," as used in this provision, means a small business concern--

(1) Which is at least 51 percent owned by one or more women or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and

(2) Whose management and daily business operations are controlled by one or more women.

(d) Notice. (1) If this solicitation is for supplies and has been set aside, in whole or in part, for small business concerns, then the clause in this solicitation providing notice of the set-aside contains restrictions on the source of the end items to be furnished.



(2) Under 15 U.S.C. 645(d), any person who misrepresents a firm's status as a small or small disadvantaged business concern in order to obtain a contract to be awarded under the preference programs established pursuant to sections 8(a), 8(d), 9, or 15 of the Small Business Act or any other provision of Federal law that specifically references section 8(d) for a definition of program eligibility, shall--

- (i) Be punished by imposition of fine, imprisonment, or both;
- (ii) Be subject to administrative remedies, including suspension and debarment; and
- (iii) Be ineligible for participation in programs conducted under the authority of the Act.

(End of provision)

13 52.219-19 SMALL BUSINESS CONCERN REPRESENTATION FOR THE SMALL BUSINESS COMPETITIVENESS DEMONSTRATION PROGRAM (JAN 1997)

(a) Definition.

"Emerging small business" as used in this solicitation, means a small business concern whose size is no greater than 50 percent of the numerical size standard applicable to the standard industrial classification code assigned to a contracting opportunity.

(b) (Complete only if the Offeror has represented itself under the provision at 52.219-1 as a small business concern under the size standards of this solicitation.)

The Offeror [ ] is, [ ] is not an emerging small business.

(c) (Complete only if the Offeror is a small business or an emerging small business, indicating its size range.)

Offeror's number of employees for the past 12 months (check this column if size standard stated in solicitation is expressed in terms of number of employees) or Offeror's average annual gross revenue for the last 3 fiscal years (check this column if size standard stated in solicitation is expressed in terms of annual receipts). (Check one of the following.)

No. of Employees	Avg. Annual Gross Revenues
_____ 50 or fewer	_____ \$1 million or less
_____ 51-100	_____ \$1,000,001-\$2 million
_____ 101-250	_____ \$2,000,001-\$3.5 million
_____ 251-500	_____ \$3,500,001-\$5 million
_____ 501-750	_____ \$5,000,001-\$10 million
_____ 751-1,000	_____ \$10,000,001-\$17 million
_____ Over 1,000	_____ Over \$17 million

(End of provision)

14 52.222-21 CERTIFICATION OF NONSEGREGATED FACILITIES (APR 1984)

(a) "Segregated facilities," as used in this provision, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees, that are segregated by explicit directive or are in

fact segregated on the basis of race, color, religion, or national origin because of habit, local custom, or otherwise.

(b) By the submission of this offer, the offeror certifies that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The offeror agrees that a breach of this certification is a violation of the Equal Opportunity clause in the contract.

(c) The offeror further agrees that (except where it has obtained identical certifications from proposed subcontractors for specific time periods) it will--

(1) Obtain identical certifications from proposed subcontractors before the award of subcontracts under which the subcontractor will be subject to the Equal Opportunity clause;

(2) Retain the certifications in the files; and

(3) Forward the following notice to the proposed subcontractors (except if the proposed subcontractors have submitted identical certifications for specific time periods):

**NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENT FOR CERTIFICATIONS OF NONSEGREGATED FACILITIES.**

A Certification of Nonsegregated Facilities must be submitted before the award of a subcontract under which the subcontractor will be subject to the Equal Opportunity clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semiannually, or annually).

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

(End of provision)

(R 7-2003.14(b)(1)(A) 1970 AUG)

(R 1-12.803-10(d))

**15 52.222-22 PREVIOUS CONTRACTS AND COMPLIANCE REPORTS (APR 1984)**

The offeror represents that--

(a) It /\_/ has, /\_/ has not, participated in a previous contract or subcontract subject either to the Equal Opportunity clause of this solicitation, the clause originally contained in Section 310 of Executive Order No. 10925, or the clause contained in Section 201 of Executive Order No. 11114;

(b) It /\_/ has, /\_/ has not, filed all required compliance reports; and

(c) Representations indicating submission of required compliance reports, signed by proposed subcontractors, will be obtained before subcontract awards.

(End of provision)

(R 7-2003.14(b)(1)(B) 1973 APR)

**16 52.223-1 CLEAN AIR AND WATER CERTIFICATION (APR 1984)**

The Offeror certifies that--

(a) Any facility to be used in the performance of this proposed contract is /\_/ is not /\_/ listed on the Environmental Protection Agency (EPA) List of Violating Facilities;

(b) The Offeror will immediately notify the Contracting Officer, before

award, of the receipt of any communication from the Administrator, or a designee, of the EPA, indicating that any facility that the Offeror proposes to use for the performance of the contract is under consideration to be listed on the EPA List of Violating Facilities; and

(c) The Offeror will include a certification substantially the same as this certification, including this paragraph (c), in every nonexempt subcontract.

(End of provision)  
(AV 7-2003.71 1977 JUN)  
(AV 1-1.2302-1)

17 52.223-13 CERTIFICATION OF TOXIC CHEMICAL RELEASE REPORTING (OCT 1996)

(a) Submission of this certification is a prerequisite for making or entering into this contract imposed by Executive Order 12969, August 8, 1995.

(b) By signing this offer, the offeror certifies that---

(1) As the owner or operator of facilities that will be used in the performance of this contract that are subject to the filing and reporting requirements described in section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023) and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106), the offeror will file and continue to file for such facilities for the life of the contract the Toxic Chemical Release Inventory Form (Form R) as described in sections 313(a) and (g) of EPCRA and section 6607 of PPA; or

(2) None of its owned or operated facilities to be used in the performance of this contract is subject to the Form R filing and reporting requirements because each such facility is exempt for at least one of the following reasons: (Check each block that is applicable.)

☐ (i) The facility does not manufacture, process, or otherwise use any toxic chemicals listed under section 313(c) of EPCRA, 42 U.S.C. 11023(c);

☐ (ii) The facility does not have 10 or more full-time employees as specified in section 313(b)(1)(A) of EPCRA, 42 U.S.C. 11023(b)(1)(A);

☐ (iii) The facility does not meet the reporting thresholds of toxic chemicals established under section 313(f) of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been filed with EPA);

☐ (iv) The facility does not fall within Standard Industrial Classification Code (SIC) designations 20 through 39 as set forth in Section 19.102 of the Federal Acquisition Regulation; or

☐ (v) The facility is not located within any State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the United States Virgin Islands, the Northern Mariana Islands, or any other territory or possession over which the United States has jurisdiction.

(End of provision)

18 52.247-7022 REPRESENTATION OF EXTENT OF TRANSPORTATION BY SEA (AUG 1992)

(a) The Offeror shall indicate by checking the appropriate blank in paragraph (b) of this provision whether transportation of supplies by sea

is anticipated under the resultant contract. The term "supplies" is defined in the Transportation of Supplies by Sea clause of this solicitation.

(b) Representation. The Offeror represents that it--

\_\_\_\_\_ Does anticipate that supplies will be transported by sea in the performance of any contract or subcontract resulting from this solicitation.

\_\_\_\_\_ Does not anticipate that supplies will be transported by sea in the performance of any contract or subcontract resulting from this solicitation.

(c) Any contract resulting from this solicitation will include the Transportation of Supplies by Sea clause. If the Offeror represents that it will not use ocean transportation, the resulting contract will also include the Defense FAR Supplement clause at 252.247-7024, Notification of Transportation of Supplies by Sea.

(End of provision)

#### 19 52.0-4196 ASBESTOS SURVEY REPORT

A copy of the ASBESTOS SURVEY REPORT is located at section in this solicitation.

I certify that I have fully read and comprehend the contents of the ASBESTOS SURVEY REPORT at Section \_\_\_\_\_ and its potential impact on the contract work to be performed.

\_\_\_\_\_  
SIGNATURE

\_\_\_\_\_  
TITLE

END OF SECTION 00600

# REQUEST FOR ASSIGNMENT OF A COMMERCIAL AND GOVERNMENT ENTITY (CAGE) CODE


(See Instructions on Reverse)

Form Approved  
GSA GEN. REG. NO. 27  
MAY 1962 EDITION

Public Reporting Burden for this collection of information is estimated to average 1 minute per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Service, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0123), Washington, DC 20503. Please do not return your form to either of these agencies. Send completed form to address on reverse.

## SECTION A - TO BE COMPLETED BY INITIATOR

### 1. REQUESTING GOVERNMENT AGENCY/ACTIVITY

a. NAME U.S. Army Engineer District, #440		b. ADDRESS (Street, City, State and Zip Code) P.O. Box 2288 109 St. Joseph Street (CESAM-CT) Mobile AL 36628-0001	
2. TYPE CODE REQUESTED (X one)	3. EXCEPTION CODES		
a. TYPE A	a. CAO		
b. TYPE F	b. ADP		
4. INITIATOR			
a. TYPED NAME (Last, First, Middle Initial) Hickman, Leo J.	b. OFFICE SYMBOL CESAM-CT-C	c. SIGNATURE 	d. TELEPHONE NO. (334) 441-5665

## SECTION B - TO BE COMPLETED BY FIRM TO BE CODED

1. FIRM		2. PARENT COMPANY AND AFFILIATED FIRMS (X one, and complete as applicable)	
a. NAME (Include branch of, Division of, etc.)	b. ADDRESS (Street, City, State and Zip Code)	a. NONE	
c. CAGE CODE (if previously assigned)		b. CURRENTLY AFFILIATED WITH OTHER FIRMS (List name(s) and address(es) of such firms on a separate sheet of paper)	
3. IF FIRM PREVIOUSLY OPERATED UNDER OTHER NAME(S) OR OTHER ADDRESS(ES) SPECIFY THE PREVIOUS NAME(S) AND/OR ADDRESS(ES) (Use separate sheet of paper, if necessary)		c. PREVIOUSLY AFFILIATED WITH OTHER FIRMS (List name(s) and address(es) of such firms on a separate sheet of paper)	
4. PRIMARY BUSINESS CATEGORY (X one)	5. DISADVANTAGED SMALL BUSINESS STATUS (X one)	6. NUMBER OF EMPLOYEES	
a. MANUFACTURER	a. APPROVED BY SMALL BUSINESS ADMINISTRATION (SBA) FOR SECTION 8(a) PROGRAM	7. WOMAN OWNED BUSINESS (X one)	
b. DEALER/DISTRIBUTOR	b. OTHER DISADVANTAGED SMALL BUSINESS FIRM	a. YES	
c. CONSTRUCTION FIRM	c. NOT DISADVANTAGED SMALL BUSINESS FIRM	b. NO	
d. SERVICE COMPANY		8. STANDARD INDUSTRIAL CLASSIFICATION (SIC) CODE(S)	
e. SALES OFFICE		a. PRIMARY	
f. OTHER (Specify)		b. OTHER (Specify)	
9. REMARKS			

### 10. FIRM OFFICIAL

a. TYPED NAME (Last, First, Middle Initial)	b. DATE SIGNED (YYMMDD)	c. SIGNATURE	d. TELEPHONE NO.
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# GENERAL NOTE FOR PERSONNEL PREPARING OR PROCESSING THIS REPORT

Coding must be as indicated in the instructions. In cases where specific coding instructions are provided, reference must be made to the Department of Defense Manual for Standard Data Elements, DoD S000.12-M. Noncompliance with either the coding instructions contained herein or those published in referenced manual will make the organization which fails to comply responsible for required concessions in data base communication.

## SPECIFIC INSTRUCTIONS

SECTION A - TO BE COMPLETED BY THE INITIATING GOVERNMENT ACTIVITY	SECTION B - (Continued)
Item 1: Self-explanatory.	Item 4: Self-explanatory.
Item 2: Mark the type of code being requested.  a. Type A - Manufacturers Code which is used in the Federal Catalog System to identify a certain facility at a specific location which is a possible source for the manufacture and/or design control of items cataloged by the Federal Government; or,  b. Type F - Non-manufacturers Code which is required for identifying an organization/function in MILSCAP. These are assigned to contractors which are non-manufacturers or are manufacturers not qualifying for a Type A Code.	Item 5: A disadvantaged business firm is defined as a firm that is 51%, or more, owned, controlled, and operated by a person(s) who is socially and economically disadvantaged. "Controlled" is defined as exercising the power to make policy decisions. "Operated" is defined as actively involved in the day-to-day management of the firm.  Item 6: Enter the number of employees. This number should include the employees of all affiliates.  Item 7: A woman-owned business is defined as a firm that is 51%, or more, owned, controlled, and operated by a woman or women. "Controlled" and "Operated" are as defined in Item 5.
Item 3: If applicable, enter the exception DoD Activity Address Code for the Servicing Contract Administration Office (CAO) or ADP point.	Item 8: The SIC Code is a Government Index used to identify business activity and indicates the function (manufacturer, wholesaler, retailer, or service) and the line of business in which the company is engaged. If multiple SIC Codes, indicate the primary first, next important, etc.
Item 4: Self-explanatory.	
SECTION B - TO BE COMPLETED BY THE FIRM TO WHICH THE CODE WILL BE ASSIGNED	Items 9 and 10: Self-explanatory.
Items 1a and 1b: Self-explanatory.	<p><b>NOTE:</b> When any future changes are made to the coded facility; i.e., name change, location change, business sold or operations discontinued, etc., written notification stating the appropriate change should be sent to:</p> <p>Commander Defense Logistics Services Center ATTN: DLSC-FBA Federal Center 74 North Washington Battle Creek, MI 49017-3084</p> <p>Mail this completed form to:</p>
Item 1c: If a CAGE Code (Type A or Type F) was previously assigned, enter it in this block.	
Item 2: Self-explanatory.	
Item 3: If a block other than "None" is marked, identify the Parent company by a (P) beside the firm name.	

**EXPLANATION OF APPLICABILITY OF CERTAIN CLAUSES IN SECTION 00700  
(IFB)**

<u>REGULATION</u>	<u>CLAUSE TITLE</u>
52.0203-7002	DISPLAY OF DOD HOTLINE POSTER (Applicable to contracts in excess of \$5 million)
52.0211-0015	DEFENSE PRIORITY AND ALLOCATION REQUIREMENTS (Applicable when solicitation prefix is "DACA01")
52.0219-0009 I	SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS SUBCONTRACTING PLAN, ALT I (Applicable to large businesses with contracts in excess of \$1 million.)
52.0219-0016	LIQUIDATED DAMAGES-SUBCONTRACTING PLAN (Applicable to large businesses with contracts in excess of \$1 million.)
52.0219-7003	SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS SUBCONTRACTING PLAN (DOD CONTRACTS) (Applicable to large businesses with contracts in excess of \$1 million.)
52.0225-0005	BUY AMERICAN ACT-CONSTRUCTION MATERIALS (Applicable to contracts less than \$6.5 million)
52.0025-0015 I	BUY AMERICAN ACT-CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS ACT AND NORTH AMERICAN FREE TRADE AGREEMENT-ALT I (Applicable to contracts with value from \$6,500,000 to \$7,311,000)
52-0025-0015	BUY AMERICAN ACT-CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS ACT AND NORTH AMERICAN FREE TRADE AGREEMENT (Applicable to contracts with value of \$7,311,000 or more)
52.0226-0001	UTILIZATION OF INDIAN ORGANIZATIONS AND INDIAN-OWNED ECONOMIC ENTERPRISES (Applicable to contracts in excess of \$1 million and to which the clause at FAR 52.219-9 applies)  RETAINAGE-SMALL BUSINESS SUBCONTRACTING REPORTING (Applicable to large businesses when the contract is in excess of \$1 million)

Revised 3-14-97

**EXPLANATION OF APPLICABILITY OF CERTAIN CLAUSES IN SECTION 00700  
(IFB)**

<b><u>REGULATION</u></b>	<b><u>CLAUSE TITLE</u></b>
52.0203-7002	DISPLAY OF DOD HOTLINE POSTER (Applicable to contracts in excess of \$5 million)
52.0211-0015	DEFENSE PRIORITY AND ALLOCATION REQUIREMENTS (Applicable when solicitation prefix is "DACA01")
52.0215-0022	PRICE REDUCTION FOR DEFECTIVE COST OR PRICING DATA (Applicable to any single source contract, including 8(a), of \$500,000 or more.)
52.0215-0024	SUBCONTRACTOR COST OR PRICING DATA (Applicable to any single source contract, including 8(a), of \$500,000 or more.)
52.0215-0023	PRICE REDUCTION FOR DEFECTIVE COST OR PRICING DATA-MODIFICATIONS (Applicable to competitive solicitations including competitive 8(a) projects)
52.0215-0025	SUBCONTRACTOR COST OR PRICING DATA-MODIFICATIONS (Applicable to competitive solicitations including competitive 8(a) projects)
52.0215-0039	REVERSION OR ADJUSTMENT OF PLANS FOR POST-RETIREMENT BENEFITS OTHER THAN PENSIONS (Applicable to any single source contract, including 8(a), of \$500,000 or more.)
52.0215-0040	NOTIFICATION OF OWNERSHIP CHANGES (Applicable to any single source contract, including 8(a), of \$500,000 or more.)
52.0215-0041	REQUIREMENTS FOR COST OR PRICING DATA OR INFORMATION OTHER THAN COST OR PRICING DATA-MODIFICATIONS (Applicable to any single source contract, including 8(a), of \$500,000 or more.)
52.0219-0009	SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS SUBCONTRACTING PLAN (Applicable to large businesses with contracts in excess of \$1 million)
52.0219-0016	LIQUIDATED DAMAGES-SUBCONTRACTING PLAN (Applicable to large businesses with contracts in excess of \$1 million)

Revised 3-14-97



**EXPLANATION OF APPLICABILITY OF CERTAIN CLAUSES IN SECTION 00700  
(IFB)**

<u>REGULATION</u>	<u>CLAUSE TITLE</u>
52.0219-7003	SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS SUBCONTRACTING PLAN (DOD CONTRACTS) (Applicable to large businesses with contracts in excess of \$1 million.)
52.0225-0005	BUY AMERICAN ACT-CONSTRUCTION MATERIALS (Applicable to contracts less than \$6.5 million.)
52.0225-0015 I	BUY AMERICAN ACT-CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS ACT AND NORTH AMERICAN FREE TRADE AGREEMENT-ALT I (Applicable to contracts with value from \$6,500,000 to \$7,311,000)
52.0225-0015	BUY AMERICAN ACT-CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS ACT AND NORTH AMERICAN FREE TRADE AGREEMENT (Applicable to contracts with value of \$7,311,000 or more)
52.0226-0001	UTILIZATION OF INDIAN ORGANIZATIONS AND INDIAN- OWNED ECONOMIC ENTERPRISES (Applicable to contracts in excess of \$1 million and to which the clause at FAR 52.219-9 applies)
	RETAINAGE-SMALL BUSINESS SUBCONTRACTING REPORTING (Applicable to large businesses when the contract is in excess of \$1 million)

Revised 3-14-97

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## SECTION 00700

### CONTRACT CLAUSES

#### 1 52.252-2 CLAUSES INCORPORATED BY REFERENCE (JUN 1988)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available.

(End of clause)

#### 2 52.0-4198 DEFINITIONS

(The following clause is applicable if the procurement instrument identification number is prefixed by the letters "DACW".)

(a) The term "head of the agency" or Secretary" as used herein means the Secretary of the Army; and the term "his duly authorized representative" means the Chief of Engineers, Department of the Army, or an individual or board designated by him.

(b) "Contracting Officer" means a person with the authority to enter into, administer, and/or terminate contracts and make related determinations and findings. The term includes certain authorized representatives of the Contracting Officer acting within the limits of their authority as delegated by the Contracting Officer.

(c) The agency board of contract appeals having jurisdiction over all appeals from final decisions of the Contracting Officer under the Contract Disputer Act of 1978 is the Corps of Engineers Board of Contract Appeals, Office of the Chief of Engineers, Pulaski Building, 20 Massachusetts Avenue, N.W., Washington, D.C. 20314.#

#### 3 52.0-4199 DEFINITIONS

(The following clause is applicable if the procurement instrument identification number is prefixed by the letters "DACA".)

(a) "Head of the agency" (also called "agency head") or "Secretary" means the Secretary (or Attorney General, Administrator, Governor, Chairperson, or other chief official, as appropriate) of the agency, including any deputy or assistant chief official of the agency, and, in the

Department of Defense, the Under Secretary and any Assistant Secretary of the Departments of the Army, Navy, and Air Force and the Director and Deputy Director of Defense agencies; and the term "authorized representative" means any person, persons, or board (other than the Contracting Officer) authorized to act for the head of the agency or Secretary.

(b) "Contracting Officer" means a person with the authority to enter into, administer, and/or terminate contracts and make related determinations and findings. The term includes certain authorized representatives of the Contracting Officer acting within the limits of their authority as delegated by the Contracting Officer.

(c) The agency board of contract appeals having jurisdiction over all appeals from final decisions of the Contracting Officer under the Contract Disputes Act of 1978 is the Armed Services Board of Contract Appeals, 200 Stovall Street, Alexandria, Virginia 22332.#

#### 4 52.201-7000 CONTRACTING OFFICER'S REPRESENTATIVE (DEC 1991)

(a) Definition. "Contracting officer's representative" means an individual designated in accordance with subsection 201.602-2 of the Defense Federal Acquisition Regulation Supplement and authorized in writing by the Contracting Officer to perform specific technical or administrative functions.

(b) If the Contracting Officer designates a contracting officer's representative (COR), the Contractor will receive a copy of the written designation. It will specify the extent of the COR's authority to act on behalf of the Contracting Officer. The COR is not authorized to make any commitments or changes that will affect price, quality, quantity, delivery, or any other term or condition of the contract.

(End of clause)

#### 5 52.203-3 GRATUITIES (APR 1984)

(a) The right of the Contractor to proceed may be terminated by written notice if, after notice and hearing, the agency head or a designee determines that the Contractor, its agent, or another representative--

(1) Offered or gave a gratuity (e.g., an entertainment or gift) to an officer, official, or employee of the Government; and

(2) Intended, by the gratuity, to obtain a contract or favorable treatment under a contract.

(b) The facts supporting this determination may be reviewed by any

court having lawful jurisdiction.

(c) If this contract is terminated under paragraph (a) above, the Government is entitled--

(1) To pursue the same remedies as in a breach of the contract; and

(2) In addition to any other damages provided by law, to exemplary damages of not less than 3 nor more than 10 times the cost incurred by the Contractor in giving gratuities to the person concerned, as determined by the agency head or a designee. (This subparagraph (c)(2) is applicable only if this contract uses money appropriated to the Department of Defense.)

(d) The rights and remedies of the Government provided in this clause shall not be exclusive and are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

(R 7-104.16 1952 MAR)

6 52.203-5 COVENANT AGAINST CONTINGENT FEES (APR 1984)

(a) The Contractor warrants that no person or agency has been employed or retained to solicit or obtain this contract upon an agreement or understanding for a contingent fee, except a bona fide employee or agency. For breach or violation of this warranty, the Government shall have the right to annul this contract without liability or, in its discretion, to deduct from the contract price or consideration, or otherwise recover, the full amount of the contingent fee.

(b) "Bona fide agency," as used in this clause, means an established commercial or selling agency, maintained by a contractor for the purpose of securing business, that neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds itself out as being able to obtain any Government contract or contracts through improper influence.

"Bona fide employee," as used in this clause, means a person, employed by a Contractor and subject to the Contractor's supervision and control as to time, place, and manner of performance, who neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds out as being able to obtain any Government contract or contracts through improper influence.

"Contingent fee," as used in this clause, means any commission, percentage, brokerage, or other fee that is contingent upon the success that a person or concern has in securing a Government contract.

"Improper influence," as used in this clause, means any influence that induces or tends to induce a Government employee or officer to give



consideration or to act regarding a Government contract on any basis other than the merits of the matter.

(End of clause)

(R 7-103.20 1958 JAN)

(R 1-1.503)

(R 1-7.102-18)

7 52.203-7 ANTI-KICKBACK PROCEDURES (JUL 1995)

(a) Definitions.

"Kickback," as used in this clause, means any money, fee, commission, credit, gift, gratuity, thing of value, or compensation of any kind which is provided, directly or indirectly, to any prime Contractor, prime Contractor employee, subcontractor, or subcontractor employee for the purpose of improperly obtaining or rewarding favorable treatment in connection with a prime contract or in connection with a subcontract relating to a prime contract.

"Person," as used in this clause, means a corporation, partnership, business association of any kind, trust, joint-stock company, or individual.

"Prime contract," as used in this clause, means a contract or contractual action entered into by the United States for the purpose of obtaining supplies, materials, equipment, or services of any kind.

"Prime Contractor" as used in this clause, means a person who has entered into a prime contract with the United States.

"Prime Contractor employee," as used in this clause, means any officer, partner, employee, or agent of a prime Contractor.

"Subcontract," as used in this clause, means a contract or contractual action entered into by a prime Contractor or subcontractor for the purpose of obtaining supplies, materials, equipment, or services of any kind under a prime contract.

"Subcontractor," as used in this clause, (1) means any person, other than the prime Contractor, who offers to furnish or furnishes any supplies, materials, equipment, or services of any kind under a prime contract or a subcontract entered into in connection with such prime contract, and (2) includes any person who offers to furnish or furnishes general supplies to the prime Contractor or a higher tier subcontractor.

"Subcontractor employee," as used in this clause, means any officer, partner, employee, or agent of a subcontractor.

(b) The Anti-Kickback Act of 1986 (41 U.S.C. 51-58) (the Act), prohibits any person from--

(1) Providing or attempting to provide or offering to provide any

kickback;

(2) Soliciting, accepting, or attempting to accept any kickback; or

(3) Including, directly or indirectly, the amount of any kickback in the contract price charged by a prime Contractor to the United States or in the contract price charged by a subcontractor to a prime Contractor or higher tier subcontractor.

(c)(1) The Contractor shall have in place and follow reasonable procedures designed to prevent and detect possible violations described in paragraph (b) of this clause in its own operations and direct business relationships.

(2) When the Contractor has reasonable grounds to believe that a violation described in paragraph (b) of this clause may have occurred, the Contractor shall promptly report in writing the possible violation. Such reports shall be made to the inspector general of the contracting agency, the head of the contracting agency if the agency does not have an inspector general, or the Department of Justice.

(3) The Contractor shall cooperate fully with any Federal agency investigating a possible violation described in paragraph (b) of this clause.

(4) The Contracting Officer may (i) offset the amount of the kickback against any monies owed by the United States under the prime contract and/or (ii) direct that the Prime Contractor withhold from sums owed a subcontractor under the prime contract the amount of the kickback. The Contracting Officer may order that monies withheld under subdivision (c)(4)(ii) of this clause be paid over to the Government unless the Government has already offset those monies under subdivision (c)(4)(i) of this clause. In either case, the Prime Contractor shall notify the Contracting Officer when the monies are withheld.

(5) The Contractor agrees to incorporate the substance of this clause, including subparagraph (c)(5) but excepting subparagraph (c)(1), in all subcontracts under this contract which exceed \$100,000.

(End of clause)

#### 8 52.203-8 REQUIREMENT FOR CERTIFICATE OF PROCUREMENT INTEGRITY (SEPT 1995)

(a) Definitions. The definitions at FAR 3.104-4 are hereby incorporated in this provision.

(b) Certifications. As required in paragraph (c) of this provision, the officer or employee responsible for this offer shall execute the following certification. The certification in paragraph (b)(2) of this provision is not required for a procurement of commercial items.

CERTIFICATE OF PROCUREMENT INTEGRITY

(1) I, \_\_\_\_\_ [Name of certifier], am the officer or employee responsible for the preparation of this offer and hereby certify that, to the best of my knowledge and belief, with the exception of any information described in this certificate, I have no information concerning a violation or possible violation of subsection 27(a), (b), (d), or (f) of the Office of Federal Procurement Policy Act, as amended+ (41.U.S.C. 423), (hereinafter referred to as "the Act"), as implemented in the FAR, occurring during the conduct of this procurement \_\_\_\_\_ (solicitation number).

(2) As required by subsection 27(e)(1)(B) of the Act, I further certify that, to the best of my knowledge and belief, each officer, employee, agent, representative, and consultant of \_\_\_\_\_ [Name of Offeror] who has participated personally and substantially in the preparation or submission of this offer has certified that he or she is familiar with, and will comply with, the requirements of subsection 27(a) of the Act, as implemented in the FAR, and will report immediately to me any information concerning a violation or possible violation of subsections 27(a), (b), (d), or (f) of the Act, as implemented in the FAR, pertaining to this procurement.

(3) Violations or possible violations: (Continue on plain bond paper if necessary and label Certificate of Procurement Integrity (Continuation Sheet), ENTER NONE IF NONE EXIST)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
(4) I agree that, if awarded a contract under this solicitation, the certifications required by subsection 27(e)(1)(B) of the Act shall be maintained in accordance with paragraph (f) of this provision.

\_\_\_\_\_  
[Signature of the officer or employee responsible for the offer and date]

\_\_\_\_\_  
[Typed name of the officer or employee responsible for the offer]

+ Subsections 27(a), (b), and (d) are effective on December 1, 1990.

Subsection 27(f) is effective on June 1, 1991.

THIS CERTIFICATION CONCERNS A MATTER WITHIN THE JURISDICTION OF AN AGENCY OF THE UNITED STATES AND THE MAKING OF A FALSE, FICTITIOUS, OR FRAUDULENT CERTIFICATION MAY RENDER THE MAKER SUBJECT TO PROSECUTION UNDER TITLE 18, UNITED STATES CODE, SECTION 1001.

(End of certification)

(c)(1) For procurements using sealed bidding procedures, the signed certifications shall be submitted by each bidder with the bid submission except for procurements using two-step sealed bidding procedure (see

Subpart 14.5). For those procurements, the certifications shall be submitted with submission of the step two sealed bids. A certificate is not required for indefinite delivery contracts (see Subpart 16.5) unless the total estimated value of all orders eventually to be placed under the contract is expected to exceed \$100,000.

(2) For contracts and contract modifications which include options, a certificate is required when the aggregate value of the contract or contract modification and all options (see 3.104-4(e)) exceeds \$100,000.

(3) Failure of a bidder to submit the signed certificate with its bid shall render the bid nonresponsive.

(d) Pursuant to FAR 3.104-9(d), the Offeror may be requested to execute additional certifications at the request of the Government. Failure of an Offeror to submit the additional certifications shall cause its offer to be rejected.

(e) A certification containing a disclosure of a violation or possible violation will not necessarily result in the withholding of award under this solicitation. However, the Government, after evaluation of the disclosure, may cancel this procurement or take any other appropriate actions in the interests of the Government, such as disqualification of the Offeror.

(f) In making the certification in paragraph (2) of the certificate, the officer or employee of the competing Contractor responsible for the offer may rely upon a one-time certification from each individual required to submit a certification to the competing Contractor, supplemented by periodic training. These certifications shall be obtained at the earliest possible date after an individual required to certify begins employment or association with the Contractor. If a Contractor decides to rely on a certification executed prior to the suspension of section 27 (i.e., prior to December 1, 1989), the Contractor shall ensure that an individual who has so certified is notified that section 27 has been reinstated. These certifications shall be maintained by the Contractor for 6 years from the date a certifying employee's employment with the company ends or, for an agent, representative, or consultant, 6 years from the date such individual ceases to act on behalf of the Contractor.

(g) Certifications under paragraphs (b) and (d) of this provision are material representations of fact upon which reliance will be placed in awarding a contract.

(End of provision)

(a) Definitions. The definitions set forth in FAR 3.104-4 are hereby incorporated in this clause.

(b) The Contractor agrees that it will execute the certification set forth in paragraph (c) of this clause when requested by the Contracting Officer in connection with the execution of any modification of this contract.

(c) Certification. As required in paragraph (b) of this clause, the officer or employee responsible for the modification proposal shall execute the following certification. The certification in paragraph (c)(2) of this clause is not required for a modification which procures commercial items.

CERTIFICATE OF PROCUREMENT INTEGRITY--MODIFICATION (NOV 1990)

(1) I, \_\_\_\_\_ [Name of certifier] am the officer or employee responsible for the preparation of this modification proposal and hereby certify that, to the best of my knowledge and belief, with the exception of any information described in this certification, I have no information concerning a violation or possible violation of subsection 27(a), (b), (d) or (f) of the Office of Federal Procurement Policy Act, as amended+ (41 U.S.C. 423), (hereinafter referred to as "the Act"), as implemented in the FAR, occurring during the conduct of this procurement \_\_\_\_\_ (contract and modification number).

(2) As required by subsection 27(e)(1)(B) of the Act, I further certify that to the best of my knowledge and belief, each officer, employee, agent, representative, and consultant of \_\_\_\_\_ [Name of Offeror] who has participated personally and substantially in the preparation or submission of this proposal has certified that he or she is familiar with, and will comply with, the requirements of subsection 27(a) of the Act, as implemented in the FAR, and will report immediately to me any information concerning a violation or possible violation of subsections 27(a), (b), (d), or (f) of the Act, as implemented in the FAR, pertaining to this procurement.

(3) Violations or possible violations: (Continue on plain bond paper if necessary and label Certificate of Procurement Integrity--Modification (Continuation Sheet), ENTER "NONE" IF NONE EXISTS)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

[Signature of the officer or employee responsible for the modification proposal and date]

\_\_\_\_\_  
[Typed name of the officer or employee responsible for the modification]

proposal]

+ Subsections 27(a), (b), and (d) are effective on December 1, 1990.

Subsection 27(f) is effective on June 1, 1991.

THIS CERTIFICATION CONCERNS A MATTER WITHIN THE JURISDICTION OF AN AGENCY OF THE UNITED STATES AND THE MAKING OF A FALSE, FICTITIOUS, OR FRAUDULENT CERTIFICATION MAY RENDER THE MAKER SUBJECT TO PROSECUTION UNDER TITLE 18, UNITED STATES CODE, SECTION 1001.

(End of certification)

(d) In making the certification in paragraph (2) of the certificate, the officer or employee of the competing Contractor responsible for the offer or bid, may rely upon a one-time certification from each individual required to submit a certification to the competing Contractor, supplemented by periodic training. These certifications shall be obtained at the earliest possible date after an individual required to certify begins employment or association with the Contractor. If a Contractor decides to rely on a certification executed prior to the suspension of section 27 (i.e., prior to December 1, 1989), the Contractor shall ensure that an individual who has so certified is notified that section 27 has been reinstated. These certifications shall be maintained by the Contractor for a period of 6 years from the date a certifying employee's employment with the company ends or, for an agency, representative, or consultant, 6 years from the date such individual ceases to act on behalf of the Contractor.

(e) The certification required by paragraph (c) of this clause is a material representation of fact upon which reliance will be placed in executing this modification.

(End of clause)

#### 10 52.203-10 PRICE OR FEE ADJUSTMENT FOR ILLEGAL OR IMPROPER ACTIVITY (SEP 1990)

(a) The Government, at its election, may reduce the price of a fixed-price type contract or contract modification and the total cost and fee under a cost-type contract or contract modification by the amount of profit or fee determined as set forth in paragraph (b) of this clause if the head of the contracting activity or his or her designee determines that there was a violation of subsection 27(a) of the Office of Federal Procurement Policy Act, as amended (41 U.S.C. 423), as implemented in the FAR. In the case of a contract modification, the fee subject to reduction is the fee specified in the particular contract modification at the time of execution, except as provided in subparagraph (b)(5) of this clause.

(b) The price or fee reduction referred to in paragraph (a) of this clause shall be--

(1) For cost-plus-fixed-fee contracts, the amount of the fee specified in the contract at the time of award;

(2) For cost-plus-incentive-fee contracts, the target fee specified in the contract at the time of award, notwithstanding any minimum fee or "fee floor" specified in the contract;

(3) For cost-plus-award-fee contracts--

(i) The base fee established in the contract at the time of contract award;

(ii) If no base fee is specified in the contract, 30 percent of the amount of each award fee otherwise payable to the Contractor for each award fee evaluation period or at each award fee determination point.

(4) For fixed-price-incentive contracts, the Government may--

(i) Reduce the contract target price and contract target profit both by an amount equal to the initial target profit specified in the contract at the time of contract award; or

(ii) If an immediate adjustment to the contract target price and contract target profit would have a significant adverse impact on the incentive price revision relationship under the contract, or adversely affect the contract financing provisions, the Contracting Officer may defer such adjustment until establishment of the total final price of the contract. The total final price established in accordance with the incentive price revision provisions of the contract shall be reduced by an amount equal to the initial target profit specified in the contract at the time of contract award and such reduced price shall be the total final contract price.

(5) For firm-fixed-price contracts or contract modifications, by 10 percent of the initial contract price; 10 percent of the contract modification price; or a profit amount determined by the Contracting Officer from records or documents in existence prior to the date of the contract award or modification.

(c) The Government may, at its election, reduce a prime contractor's price or fee in accordance with the procedures of paragraph (b) of this clause for violations of the Act by its subcontractors by an amount not to exceed the amount of profit or fee reflected in the subcontract at the time the subcontract was first definitively priced.

(d) In addition to the remedies in paragraphs (a) and (c) of this clause, the Government may terminate this contract for default. The rights and remedies of the Government specified herein are not exclusive, and are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

1990)

(a) Definitions.

"Agency," as used in this clause, means executive agency as defined in 2.101.

"Covered Federal action," as used in this clause, means any of the following Federal actions:

- (a) The awarding of any Federal contract.
- (b) The making of any Federal grant.
- (c) The making of any Federal loan.
- (d) The entering into of any cooperative agreement.
- (e) The extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

"Indian tribe" and "tribal organization," as used in this clause, have the meaning provided in section 4 of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450B) and include Alaskan Natives.

"Influencing or attempting to influence," as used in this clause, means making, with the intent to influence, any communication to or appearance before an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with any covered Federal action.

"Local government," as used in this clause, means a unit of government in a State and, if chartered, established, or otherwise recognized by a State for the performance of a governmental duty, including a local public authority, a special district, an intrastate district, a council of governments, a sponsor group representative organization, and any other instrumentality of a local government.

"Officer or employee of an agency," as used in this clause, includes the following individuals who are employed by an agency:

- (a) An individual who is appointed to a position in the Government under title 5, United States Code, including a position under a temporary appointment.
- (b) A member of the uniformed services, as defined in subsection 101(3), title 37, United States Code.
- (c) A special Government employee, as defined in section 202, title 18, United States Code.
- (d) An individual who is a member of a Federal advisory committee, as defined by the Federal Advisory Committee Act, title 5, United States Code, appendix 2.

"Person," as used in this clause, means an individual, corporation, company, association, authority, firm, partnership, society, State, and



local government, regardless of whether such entity is operated for profit, or not for profit. This term excludes an Indian tribe, tribal organization, or any other Indian organization with respect to expenditures specifically permitted by other Federal law.

"Reasonable compensation," as used in this clause, means, with respect to a regularly employed officer or employee of any person, compensation that is consistent with the normal compensation for such officer or employee for work that is not furnished to, not funded by, or not furnished in cooperation with the Federal Government.

"Reasonable payment," as used in this clause, means, with respect to professional and other technical services, a payment in an amount that is consistent with the amount normally paid for such services in the private sector.

"Recipient," as used in this clause, includes the Contractor and all subcontractors. This term excludes an Indian tribe, tribal organization, or any other Indian organization with respect to expenditures specifically permitted by other Federal law.

"Regularly employed," as used in this clause, means, with respect to an officer or employee of a person requesting or receiving a Federal contract, an officer or employee who is employed by such person for at least 130 working days within 1 year immediately preceding the date of the submission that initiates agency consideration of such person for receipt of such contract. An officer or employee who is employed by such person for less than 130 working days within 1 year immediately preceding the date of the submission that initiates agency consideration of such person shall be considered to be regularly employed as soon as he or she is employed by such person for 130 working days.

"State," as used in this clause, means a State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, a territory or possession of the United States, an agency or instrumentality of a State, and multi-State, regional, or interstate entity having governmental duties and powers.

(b) Prohibitions.

(1) Section 1352 of title 31, United States Code, among other things, prohibits a recipient of a Federal contract, grant, loan, or cooperative agreement from using appropriated funds to pay any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with any of the following covered Federal actions: the awarding of any Federal contract; the making of any Federal grant; the making of any Federal loan; the entering into of any cooperative agreement; or the modification of any Federal contract, grant, loan, or cooperative agreement.

(2) The Act also requires Contractors to furnish a disclosure if any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a Federal contract, grant, loan, or cooperative agreement.

(3) The prohibitions of the Act do not apply under the following conditions:

(i) Agency and legislative liaison by own employees.

(A) The prohibition on the use of appropriated funds, in subparagraph (b)(1) of this clause, does not apply in the case of a payment of reasonable compensation made to an officer or employee of a person requesting or receiving a covered Federal action if the payment is for agency and legislative liaison activities not directly related to a covered Federal action.

(B) For purposes of subdivision (b)(3)(i)(A) of this clause, providing any information specifically requested by an agency or Congress is permitted at any time.

(C) The following agency and legislative liaison activities are permitted at any time where they are not related to a specific solicitation for any covered Federal action:

(1) Discussing with an agency the qualities and characteristics (including individual demonstrations) of the person's products or services, conditions or terms of sale, and service capabilities.

(2) Technical discussions and other activities regarding the application or adaptation of the person's products or services for an agency's use.

(D) The following agency and legislative liaison activities are permitted where they are prior to formal solicitation of any covered Federal action--

(1) Providing any information not specifically requested but necessary for an agency to make an informed decision about initiation of a covered Federal action;

(2) Technical discussions regarding the preparation of an unsolicited proposal prior to its official submission; and

(3) Capability presentations by persons seeking awards from an agency pursuant to the provisions of the Small Business Act, as amended by Pub. L. 95-507, and subsequent amendments.

(E) Only those services expressly authorized by subdivision (b)(3)(i)(A) of this clause are permitted under this clause.

(ii) Professional and technical services.

(A) The prohibition on the use of appropriated funds, in

subparagraph (b)(1) of this clause, does not apply in the case of--

(1) A payment of reasonable compensation made to an officer or employee of a person requesting or receiving a covered Federal action or an extension, continuation, renewal, amendment, or modification of a covered Federal action, if payment is for professional or technical services rendered directly in the preparation, submission, or negotiation of any bid, proposal, or application for that Federal action or for meeting requirements imposed by or pursuant to law as a condition for receiving that Federal action.

(2) Any reasonable payment to a person, other than an officer or employee of a person requesting or receiving a covered Federal action or an extension, continuation, renewal, amendment, or modification of a covered Federal action if the payment is for professional or technical services rendered directly in the preparation, submission, or negotiation of any bid, proposal, or application for that Federal action or for meeting requirements imposed by or pursuant to law as a condition for receiving that Federal action. Persons other than officers or employees of a person requesting or receiving a covered Federal action include consultants and trade associations.

(B) For purposes of subdivision (b)(3)(ii)(A) of this clause, "professional and technical services" shall be limited to advice and analysis directly applying any professional or technical discipline. For example, drafting of a legal document accompanying a bid or proposal by a lawyer is allowable. Similarly, technical advice provided by an engineer on the performance or operational capability of a piece of equipment rendered directly in the negotiation of a contract is allowable. However, communications with the intent to influence made by a professional (such as a licensed lawyer) or a technical person (such as a licensed accountant) are not allowable under this section unless they provide advice and analysis directly applying their professional or technical expertise and unless the advice or analysis is rendered directly and solely in the preparation, submission or negotiation of a covered Federal action. Thus, for example, communications with the intent to influence made by a lawyer that do not provide legal advice or analysis directly and solely related to the legal aspects of his or her client's proposal, but generally advocate one proposal over another are not allowable under this section because the lawyer is not providing professional legal services. Similarly, communications with the intent to influence made by an engineer providing an engineering analysis prior to the preparation or submission of a bid or proposal are not allowable under this section

since the engineer is providing technical services but not directly in the preparation, submission or negotiation of a covered Federal action.

(C) Requirements imposed by or pursuant to law as a condition for receiving a covered Federal award include those required by law or regulation and any other requirements in the actual award documents.

(D) Only those services expressly authorized by subdivisions (b)(3)(ii)(A)(1) and (2) of this clause are permitted under this clause.

(E) The reporting requirements of FAR 3.803(a) shall not apply with respect to payments of reasonable compensation made to regularly employed officers or employees of a person.

(c) Disclosure.

(1) The Contractor who requests or receives from an agency a Federal contract shall file with that agency a disclosure form, OMB standard form LLL, Disclosure of Lobbying Activities, if such person has made or has agreed to make any payment using nonappropriated funds (to include profits from any covered Federal action), which would be prohibited under subparagraph (b)(1) of this clause, if paid for with appropriated funds.

(2) The Contractor shall file a disclosure form at the end of each calendar quarter in which there occurs any event that materially affects the accuracy of the information contained in any disclosure form previously filed by such person under subparagraph (c)(1) of this clause. An event that materially affects the accuracy of the information reported includes--

(i) A cumulative increase of \$25,000 or more in the amount paid or expected to be paid for influencing or attempting to influence a covered Federal action; or

(ii) A change in the person(s) or individual(s) influencing or attempting to influence a covered Federal action; or

(iii) A change in the officer(s), employee(s), or Member(s) contacted to influence or attempt to influence a covered Federal action.

(3) The Contractor shall require the submittal of a certification, and if required, a disclosure form by any person who requests or receives any subcontract exceeding \$100,000 under the Federal contract.

(4) All subcontractor disclosure forms (but not certifications) shall be forwarded from tier to tier until received by the prime Contractor. The prime Contractor shall submit all disclosures to the Contracting Officer at the end of the calendar quarter in which the disclosure form is submitted by the subcontractor. Each subcontractor certification shall be retained in the subcontract file of the awarding Contractor.

(d) Agreement. The Contractor agrees not to make any payment

prohibited by this clause.

(e) Penalties.

(1) Any person who makes an expenditure prohibited under paragraph (a) of this clause or who fails to file or amend the disclosure form to be filed or amended by paragraph (b) of this clause shall be subject to civil penalties as provided for by 31 U.S.C. 1352. An imposition of a civil penalty does not prevent the Government from seeking any other remedy that may be applicable.

(2) Contractors may rely without liability on the representation made by their subcontractors in the certification and disclosure form.

(f) Cost allowability. Nothing in this clause makes allowable or reasonable any costs which would otherwise be unallowable or unreasonable. Conversely, costs made specifically unallowable by the requirements in this clause will not be made allowable under any other provision.

(End of clause)

12 52.203-7000 STATUTORY PROHIBITION ON COMPENSATION TO FORMER DEPARTMENT OF DEFENSE

EMPLOYEES (NOV 1995)

(a) Definitions. As used in this clause--

(1) "Armed Forces" means the uniformed military services, excluding the U.S. Coast Guard.

(2) "Compensation" means any payment, gift, benefit, reward, favor, or gratuity which is provided directly or indirectly for services rendered by the person accepting such payment, gift, benefit, reward, favor, or gratuity, and which has a fair market value in excess of \$250. Compensation is indirectly provided if it is paid to an entity other than the individual, specifically in exchange for services performed by the individual.

(3) "Defense contractor" means an entity (including affiliates and subsidiaries which clearly engage in the performance of Department of Defense (DoD) contracts) that contracts directly with the DoD to supply goods or services. "Defense contractor" does not include a State or local government or any person who contracts to supply the Department of Defense only commercial items.

(4) "Designated agency ethics official" means a DoD officer or employee who has been appointed to administer the provisions of the Ethics in Government Act, as amended.

(5) "Former DoD employee" means a person who served in the DoD in a

civilian position for which the rate of pay was equal to or greater than the minimum rate of pay for grade GS-13 of the General Schedule, or served in the Armed Forces in a pay grade of 04 or higher.

(6) "Former DoD official" means--

(i) A former DoD employee who spent the majority of working days during the last two years of DoD service performing a procurement function relating to:

(A) A DoD contract, at a site or plant that was owned or operated by the Contractor, and which was the principal location of such person's performance of that procurement function; or

(B) A major defense system and, in the performance of such function, participated on any occasion personally and substantially in a manner involving decision making responsibilities with respect to a contract for that system through contact with the Contractor;

(ii) An individual who served in a civilian position for which the rate of pay is equal to or greater than the minimum rate of pay for a Senior Executive Service position or other executive position at the same or higher level, and an individual who served in the Armed Forces in the pay grade of 07 or higher, if such individual during the last two years of DoD service--

(A) Acted as one of the primary Government representatives in the negotiation with a defense contractor of a DoD contractual action in an amount in excess of \$10 million; or

(B) Acted as one of the primary Government representatives in the negotiation of a settlement of an unresolved claim of such a defense contractor in an amount in excess of \$10 million. An unresolved claim shall be, for the purposes of this section, valued by the greater of the amount of the claim or the amount of the settlement.

(7) "Major defense contractor" means any business entity which, during the Government fiscal year preceding the Government fiscal year in which compensation was first provided to a former DoD employee, was awarded DoD contracts in a total amount of \$10 million or more.

(8) "Major defense system" means a combination of elements that will function together to produce the capability required to fulfill a mission need. Elements may include hardware, equipment, software, or any combination thereof, but exclude construction or other improvements to real property. A system shall be considered a major defense system if--

(i) The DoD is responsible for the system and the total expenditures (based on fiscal year 1980 constant dollars) for research, development, test and evaluation for the system, are estimated to exceed \$75 million or the eventual total expenditure for procurement is estimated to exceed \$300 million; or

(ii) The system is designated a major system by the head of the

agency responsible for the system.

(9) "Negotiation" means exchanges of positions between representatives of the Government and a contractor with the view of reaching agreement regarding respective liabilities of the parties on a particular contract or claim. It includes deliberations regarding contract specifications, terms of delivery, allowability of costs, pricing of change orders, etc.

(10) "Primary Government representative" means, if more than one Government representative is involved in any particular transaction, the official or officials supervising the Government's effort in the matter. To act as a "representative" requires personal and substantial participation in the transaction, by personal presence, telephone conversation, or similar involvement with representatives of a Contractor.

(11) "Procurement-related function" (or "procurement function") means any function relating to--

- (i) The negotiation, award, administration, or approval of a contract;
- (ii) The selection of a Contractor;
- (iii) The approval of a change in a contract;
- (iv) The performance of quality assurance, operational and developmental testing, the approval of payment, or auditing under a contract; or
- (v) The management of a procurement program.

(b) Prohibition on compensation. (1) 10 U.S.C. 2397b and 2397c prohibit a major defense Contractor from offering or providing any compensation valued in excess of \$250 to a former DoD official who left DoD service on or after April 16, 1987, and who, while employed by DoD, performed procurement-related functions in connection with that defense Contractor. This prohibition runs for the two year period beginning on the date of the official's separation from service in DoD.

(2) The Contractor, if a major defense Contractor, agrees not to provide, for the two year period, any compensation to the former DoD official.

(3) DoD employees may request from their Designated Agency Ethics Official (DAEO) a written opinion on the applicability of 10 U.S.C. 2397b prior to the acceptance of compensation. If the opinion of the DAEO is that the law is not applicable, and that the individual may accept compensation from the Contractor, there shall be a conclusive presumption that the offering and the acceptance of such compensation is not a violation of the statute.

(c) Report concerning former DoD employees. (1) The Contractor shall submit a separate written report, as described in paragraph (c)(2) of this clause, for each calendar year covered by this contract (extending through

final payment) if the calendar year commenced after the end of a Government fiscal year in which the Contractor was awarded one or more DoD contracts aggregating \$10 million or more. In multidivisional corporations, the corporate headquarters, and each segment which contracts directly with the Government, shall report separately. Each report shall list those persons employed or otherwise compensated, who are former DoD employees who left service on or after April 16, 1987, if--

- (i) They were compensated by the Contractor during the reporting period; and

- (ii) The compensation was provided within two years after the person left service in the DoD.

(2) The report shall contain:

- (i) Each person's name and the agency in which the person was employed or served on active duty during the last two years of service with DoD;

- (ii) Each person's job title(s) during the last two years of service with DoD, and a list of major defense systems on which each person performed any work;

- (iii) A complete description (exclusive of proprietary information) of any work that each person is performing, or did perform, on behalf of the Contractor during the calendar year covered by the report. If the work is classified, the Contractor may use a generalized description which will not compromise its classified nature;

- (iv) An identification of each major defense system on which each individual has performed any work on behalf of the Contractor.

(3) Submit each report not later than April 1 of the year following the end of the calendar year for which the report is being made. Send reports to the Office of the Assistant General Counsel (Legal Counsel), Standards of Conduct Office, ATTN: OAGC/LC, Pentagon, Washington, DC 20301-1600.

(4) A properly executed DD Form 1787 (Employment, Report of DoD and Defense Related) may be submitted to satisfy the reporting requirement as to any single person.

(5) The Contractor need not submit duplicate reports to the Government. Submission of a report meeting the requirements of this clause, under another, concurrent contract with DoD will satisfy the reporting requirement of this contract.

(d) Penalties for failure to comply--(1) Civil fines. A Contractor who knowingly offers or provides any compensation to a former DoD official in violation of the statute, and who knew or should have known that the acceptance of such compensation would be in violation of such statute, shall be subject to a civil fine, not to exceed \$500,000.

- (2) Liquidated damages.



(i) For each knowing violation of the statutory prohibition on providing compensation, the Contractor agrees to pay to the Government as liquidated damages the greater of either \$100,000, or three times the total amount of compensation paid by the Contractor to the former DoD official during the period in which such compensation was in violation of the statutory prohibition.

(ii) Liability for liquidated damages under this clause survives final payment under this contract and may be recouped against payments due under other contracts with the Contractor.

(iii) Liquidated damages will be computed based upon the number of actual violations by the Contractor, and not on the number of contracts in which this clause appears.

(3) Administrative penalty. If the Contractor knowingly fails to file a report in accordance with paragraph (c) of this clause, the Contractor shall be subject to an administrative penalty not to exceed \$10,000. The final determination of the penalty to be charged to the Contractor shall be made by the Secretary of Defense or designee after the Contractor is afforded an opportunity for an agency hearing on the record in accordance with agency hearing procedures. The Secretary's determination shall form a part of the record and shall be subject to judicial review under Chapter 7 of Title 5, United States Code.

(e) The rights and remedies under this clause are in addition to, and do not limit, any rights afforded the Government under this contract or as otherwise provided by law.

(End of clause)

### 13 52.203-7001 SPECIAL PROHIBITION ON EMPLOYMENT (NOV 1995)

(a) Definitions.

As used in this clause--

(1) "Arising out of a contract with the DoD" means any act in connection with--

(i) Attempting to obtain,

(ii) Obtaining, or

(iii) Performing a contract or first-tier subcontract of any agency, department, or component of the Department of Defense (DoD).

(2) "Conviction of fraud or any other felony" means any conviction for fraud or a felony in violation of state or Federal criminal statutes, whether entered on a verdict or plea, including a plea of nolo contendere, for which sentence has been imposed.

(3) "Date of conviction" means the date judgment was entered against the individual.

(b) 10 U.S.C. 2408 provides that any individual who is convicted after September 29, 1988, of fraud or any other felony arising out of a contract with the DoD is prohibited from:

- (1) Working in a management or supervisory capacity on any DoD contract or first-tier subcontract;
- (2) Serving on the board of directors of any DoD Contractor or first-tier subcontractor; or
- (3) Serving as a consultant to any DoD Contractor or first-tier subcontractor.

(c) Unless waived, the prohibition in paragraph (b) applies for five years from the date of conviction.

(d) 10 U.S.C. 2408 further provides that a defense Contractor or first-tier subcontractor shall be subject to a criminal penalty of not more than \$500,000 if convicted of knowingly--

- (1) Employing a person under a prohibition specified in paragraph (b) of this clause; or
- (2) Allowing such a person to serve on the board of directors of the Contractor or first-tier subcontractor.

(e) In addition to the criminal penalties contained in 10 U.S.C. 2408, the Government may consider other available remedies, such as--

- (1) Suspension or debarment;
- (2) Cancellation of the contract at no cost to the Government; or
- (3) Termination of the contract for default.

(f) The Contractor may submit written requests for waiver of the prohibitions in paragraph (b) of this clause to the Contracting Officer.

Requests shall clearly identify--

- (1) The person involved;
- (2) The nature of the conviction and resultant sentence or punishment imposed;
- (3) The reasons for the requested waiver; and,
- (4) An explanation of why a waiver is in the interest of national security.

(g) The Contractor agrees to include the substance of this clause, appropriately modified to reflect the identity and relationship of the parties, in all first-tier subcontracts exceeding the simplified acquisition threshold in Part 13 of the Federal Acquisition Regulation, except those for commercial items or components.

(h) Pursuant to 10 U.S.C. 2408(c), defense contractors and subcontractors may obtain information as to whether a particular person has been convicted of fraud or any other felony arising out of a contract with the DoD by contacting The Office of Justice Programs, The Denial of Benefits Office, U.S. Department of Justice, telephone (202) 307-1065.

(End of clause)

14 52.203-7002 DISPLAY OF DOD HOTLINE POSTER (DEC 1991)

(a) The Contractor shall display prominently in common work areas within business segments performing work under Department of Defense (DoD) contracts, DoD Hotline Posters prepared by the DoD Office of the Inspector General.

(b) DoD Hotline Posters may be obtained from the DoD Inspector General, ATTN: Defense Hotline, 400 Army Navy Drive, Washington, DC 22202-2884.

(c) The Contractor need not comply with paragraph (a) of this clause if it has established a mechanism, such as a hotline, by which employees may report suspected instances of improper conduct, and instructions that encourage employees to make such reports.

(End of clause)

15 52.204-4 PRINTING/COPYING DOUBLE-SIDED ON RECYCLED PAPER (JUN 1996)

(a) In accordance with Executive Order 12873, dated October 20, 1993, as amended by Executive Order 12995, dated March 25, 1996, the Offeror/Contractor is encouraged to submit paper documents, such as offers, letters, or reports, that are printed/copied double-sided on recycled paper that has at least 20 percent postconsumer material.

(b) The 20 percent standard applies to high-speed copier paper, offset paper, forms bond, computer printout paper, carbonless paper, file folders, white woven envelopes, and other uncoated printed and writing paper, such as writing and office paper, book paper, cotton fiber paper, and cover stock. An alternative to meeting the 20 percent postconsumer material standard is 50 percent recovered material content of certain industrial by-products.

(End of clause)

16 52.204-7003 CONTROL OF GOVERNMENT PERSONNEL WORK PRODUCT (APR 1992)

The Contractor's procedures for protecting against unauthorized disclosure of information shall not require Department of Defense employees or members of the Armed Forces to relinquish control of their work products, whether classified or not, to the Contractor.

(End of clause)

17 52.209-6 PROTECTING THE GOVERNMENT'S INTEREST WHEN SUBCONTRACTING WITH CONTRACTORS

DEBARRED, SUSPENDED, OR PROPOSED FOR DEBARMENT (JUL 1995)

(a) The Government suspends or debars Contractors to protect the Government's interest. The Contractor shall not enter into any subcontract in excess of \$25,000 with a Contractor that is debarred, suspended, or proposed for debarment unless there is a compelling reason to do so.

(b) The Contractor shall require each proposed first-tier subcontractor, whose subcontract will exceed \$25,000, to disclose to the Contractor, in writing, whether as of the time of award of the subcontract, the subcontractor, or its principals, is or is not debarred, suspended, or proposed for debarment by the Federal Government.

(c) A corporate officer or a designee of the Contractor shall notify the Contracting Officer, in writing, before entering into a subcontract with a party that is debarred, suspended, or proposed for debarment (see FAR 9.404 for information on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs). The notice must include the following:

(1) The name of the subcontractor.

(2) The Contractor's knowledge of the reasons for the subcontractor being on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs.

(3) The compelling reason(s) for doing business with the subcontractor notwithstanding its inclusion on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs.

(4) The systems and procedures the Contractor has established to ensure that it is fully protecting the Government's interests when dealing with such subcontractor in view of the specific basis for the party's debarment, suspension, or proposed debarment.

(End of clause)

18 52.209-7000 ACQUISITION FROM SUBCONTRACTORS SUBJECT TO ON-SITE INSPECTION UNDER THE

INTERMEDIATE-RANGE NUCLEAR FORCES (INF) TREATY (NOV 1995)

(a) The Contractor shall not deny consideration for a subcontract award under this contract to a potential subcontractor subject to on-site inspection under the INF Treaty, or a similar treaty, solely or in part

because of the actual or potential presence of Soviet inspectors at the subcontractor's facility, unless the decision is approved by the Contracting Officer.

(b) The Contractor shall incorporate this clause, including this paragraph (b), in all solicitations and contracts exceeding the simplified acquisition threshold in Part 13 of the Federal Acquisition Regulation, except those for commercial items.

(End of clause)

19 52.211-15 DEFENSE PRIORITY AND ALLOCATION REQUIREMENTS (SEP 1990)

This is a rated order certified for national defense use, and the Contractor shall follow all the requirements of the Defense Priorities and Allocations System regulation (15 CFR 700).

(End of clause)

20 52.211-18 VARIATION IN ESTIMATED QUANTITY (APR 1984)

If the quantity of a unit-priced item in this contract is an estimated quantity and the actual quantity of the unit-priced item varies more than 15 percent above or below the estimated quantity, an equitable adjustment in the contract price shall be made upon demand of either party. The equitable adjustment shall be based upon any increase or decrease in costs due solely to the variation above 115 percent or below 85 percent of the estimated quantity. If the quantity variation is such as to cause an increase in the time necessary for completion, the Contractor may request, in writing, an extension of time, to be received by the Contracting Officer within 10 days from the beginning of the delay, or within such further period as may be granted by the Contracting Officer before the date of final settlement of the contract. Upon the receipt of a written request for an extension, the Contracting Officer shall ascertain the facts and make an adjustment for extending the completion date as, in the judgement of the Contracting Officer, is justified.

(End of clause)

21 52.214-26 AUDIT AND RECORDS--SEALED BIDDING (OCT 1995)

(a) As used in this clause, records includes books, documents, accounting procedures and practices, and other data, regardless of type and regardless of whether such items are in written form, in the form of computer data, or

in any other form.

(b) Cost or pricing data. If the Contractor has been required to submit cost or pricing data in connection with the pricing of any modification to this contract, the Contracting Officer, or an authorized representative of the Contracting Officer, in order to evaluate the accuracy, completeness, and currency of the cost or pricing data, shall have the right to examine and audit all of the Contractor's records, including computations and projections, related to--

- (1) The proposal for the modification;
- (2) The discussions conducted on the proposal(s), including those related to negotiating;
- (3) Pricing of the modification; or
- (4) Performance of the modification.

(c) Comptroller General. In the case of pricing any modification, the Comptroller General of the United States, or an authorized representative, shall have the same rights as specified in paragraph (b) of this clause.

(d) Availability. The Contractor shall make available at its office at all reasonable times the materials described in reproduction, until 3 years after final payment under this contract, or for any other period specified in Subpart 4.7 of the Federal Acquisition Regulation (FAR). FAR Subpart 4.7, Contractor Records Retention, in effect on the date of this contract, is incorporated by reference in its entirety and made a part of this contract.

(1) If this contract is completely or partially terminated, the records relating to the work terminated shall be made available for 3 years after any resulting final termination settlement.

(2) Records pertaining to appeals under the Disputes clause or to litigation or the settlement of claims arising under or relating to the performance of this contract shall be made available until disposition of such appeals, litigation, or claims.

(e) The Contractor shall insert a clause containing all the provisions of this clause, including this paragraph (e), in all subcontracts expected to exceed the threshold in FAR 15.804-2(a)(1) for submission of cost or pricing data.

(End of clause)

22 52.214-27 PRICE REDUCTION FOR DEFECTIVE COST OR PRICING DATA--MODIFICATIONS--

SEALED BIDDING (OCT 1995)

(a) This clause shall become operative only for any modification to this contract involving aggregate increases and/or decreases in costs, plus

applicable profits, expected to exceed the threshold for the submission of cost or pricing data at FAR 15.804-2(a)(1), except that this clause does not apply to a modification if an exception under FAR 15.804-1 applies.

(b) If any price, including profit, negotiated in connection with any modification under this clause, was increased by any significant amount because (1) the Contractor or a subcontractor furnished cost or pricing data that were not complete, accurate, and current as certified in its Certificate of Current Cost or Pricing Data, (2) a subcontractor or prospective subcontractor furnished the Contractor cost or pricing data that were not complete, accurate, and current as certified in the Contractor's Certificate of Current Cost or Pricing Data, or (3) any of these parties furnished data of any description that were not accurate, the price shall be reduced accordingly and the contract shall be modified to reflect the reduction. This right to a price reduction is limited to that resulting from defects in data relating to modifications for which this clause becomes operative under paragraph (a) above.

(c) Any reduction in the contract price under paragraph (b) above due to defective data from a prospective subcontractor that was not subsequently awarded the subcontract shall be limited to the amount, plus applicable overhead and profit markup, by which (1) the actual subcontract or (2) the actual cost to the Contractor, if there was no subcontract, was less than the prospective subcontract cost estimate submitted by the Contractor; provided, that the actual subcontract price was not itself affected by defective cost or pricing data.

(d)(1) If the Contracting Officer determines under paragraph (b) of this clause that a price or cost reduction should be made, the Contractor agrees not to raise the following matters as a defense:

(i) The Contractor or subcontractor was a sole source supplier or otherwise was in a superior bargaining position and thus the price of the contract would not have been modified even if accurate, complete, and current cost or pricing data had been submitted.

(ii) The Contracting Officer should have known that the cost or pricing data in issue were defective even though the Contractor or subcontractor took no affirmative action to bring the character of the data to the attention of the Contracting Officer.

(iii) The contract was based on an agreement about the total cost of the contract and there was no agreement about the cost of each item procured under the contract.

(iv) The Contractor or subcontractor did not submit a Certificate of Current Cost or Pricing Data.

(2)(i) Except as prohibited by subdivision (d)(2)(ii) of this clause, an offset in an amount determined appropriate by the Contracting Officer based upon the facts shall be allowed against the amount of a contract

price reduction if--

(A) The Contractor certifies to the Contracting Officer that, to the best of the Contractor's knowledge and belief, the Contractor is entitled to the offset in the amount requested; and

(B) The Contractor proves that the cost or pricing data were available before the date of agreement on the price of the contract (or price of the modification) and that the data were not submitted before such date.

(ii) An offset shall not be allowed if--

(A) The understated data was known by the Contractor to be understated when the Certificate of Current Cost or Pricing Data was signed; or

(B) The Government proves that the facts demonstrate that the contract price would not have increased in the amount to be offset even if the available data had been submitted before the date of agreement on price.

(e) If any reduction in the contract price under this clause reduces the price of items for which payment was made prior to the date of the modification reflecting the price reduction, the Contractor shall be liable to and shall pay the United States at the time such overpayment is repaid--

(1) Simple interest on the amount of such overpayment to be computed from the date(s) of overpayment to the Contractor to the date the Government is repaid by the Contractor at the applicable underpayment rate effective for each quarter prescribed by the Secretary of the Treasury under 26 U.S.C. 6621(a)(2); and

(2) A penalty equal to the amount of the overpayment, if the Contractor or subcontractor knowingly submitted cost or pricing data which were incomplete, inaccurate, or noncurrent.

(End of clause)

## 23 52.214-28 SUBCONTRACTOR COST OR PRICING DATA--MODIFICATIONS--SEALED BIDDING

(OCT 1995)

(a) The requirements of paragraphs (b) and (c) of this clause shall (1) become operative only for any modification to this contract involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for submission of cost or pricing data at FAR 15.804-2(a)(1), and (2) be limited to such modifications.

(b) Before awarding any subcontract expected to exceed the threshold for submission of cost or pricing data at FAR 15.804-2(a)(1), on the date of agreement on price or the date of award, whichever is later; or before



pricing any subcontract modifications involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for submission of cost or pricing data at FAR 15.804-2(a)(1), the Contractor shall require the subcontractor to submit cost or pricing data (actually or by specific identification in writing), unless an exception under FAR 15.804-1 applies.

(c) The Contractor shall require the subcontractor to certify in substantially the form prescribed in subsection FAR 15.804-4 that, to the best of its knowledge and belief, the data submitted under paragraph (b) of this clause were accurate, complete, and current as of the date of agreement on the negotiated price of the subcontract or subcontract modification.

(d) The Contractor shall insert the substance of this clause, including this paragraph (d), in each subcontract that, when entered into, exceeds the threshold for submission of cost or pricing data at FAR 15.804-2(a)(1).

(End of clause)

#### 24 52.219-8 UTILIZATION OF SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL

##### BUSINESS CONCERNS (OCT 1995)

(a) It is the policy of the United States that small business concerns, small business concerns owned and controlled by socially and economically disadvantaged individuals and small business concerns owned and controlled by women shall have the maximum practicable opportunity to participate in performing contracts let by any Federal agency, including contracts and subcontracts for subsystems, assemblies, components, and related services for major systems. It is further the policy of the United States that its prime contractors establish procedures to ensure the timely payment of amounts due pursuant to the terms of their subcontracts with small business concerns, small business concerns owned and controlled by socially and economically disadvantaged individuals and small business concerns owned and controlled by women.

(b) The Contractor hereby agrees to carry out this policy in the awarding of subcontracts to the fullest extent consistent with efficient contract performance. The Contractor further agrees to cooperate in any studies or surveys as may be conducted by the United States Small Business Administration or the awarding agency of the United States as may be necessary to determine the extent of the Contractor's compliance with this clause.

(c) As used in this contract, the term "small business concern" shall mean a small business as defined pursuant to section 3 of the Small

Business Act and relevant regulations promulgated pursuant thereto. The term "small business concern owned and controlled by socially and economically disadvantaged individuals" shall mean a small business concern (1) which is at least 51 percent unconditionally owned by one or more socially and economically disadvantaged individuals; or, in the case of any publicly owned business, at least 51 per centum of the stock of which is unconditionally owned by one or more socially and economically disadvantaged individuals; and (2) whose management and daily business operations are controlled by one or more of such individuals. This term also means a small business concern that is at least 51 percent unconditionally owned by an economically disadvantaged Indian tribe or Native Hawaiian Organization, or a publicly owned business having at least 51 percent of its stock unconditionally owned by one of these entities which has its management and daily business controlled by members of an economically disadvantaged Indian tribe or Native Hawaiian Organization, and which meets the requirements of 13 CFR 124. The Contractor shall presume that socially and economically disadvantaged individuals include Black Americans, Hispanic Americans, Native Americans, Asian-Pacific Americans, Subcontinent Asian Americans, and other minorities, or any other individual found to be disadvantaged by the Administration pursuant to section 8(a) of the Small Business Act. The Contractor shall presume that socially and economically disadvantaged entities also include Indian Tribes and Native Hawaiian Organizations.

(d) The term "small business concern owned and controlled by women" shall mean a small business concern (i) which is at least 51 percent owned by one or more women, or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women, and (ii) whose management and daily business operations are controlled by one or more women; and

(e) Contractors acting in good faith may rely on written representations by their subcontractors regarding their status as a small business concern, a small business concern owned and controlled by socially and economically disadvantaged individuals or a small business concern owned and controlled by women.

(End of clause)

25 52.219-9 I SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS SUBCONTRACTING

PLAN (AUG 1996)--ALTERNATE I (OCT 1995)

(a) This clause does not apply to small business concerns.

(b) "Commercial product," as used in this clause, means a product in regular production that is sold in substantial quantities to the general public and/or industry at established catalog or market prices. It also means a product which, in the opinion of the Contracting Officer, differs only insignificantly from the Contractor's commercial product.

"Subcontract," as used in this clause, means any agreement (other than one involving an employer-employee relationship) entered into by a Federal Government prime Contractor or subcontractor calling for supplies or services required for performance of the contract or subcontract.

(c) The apparent low bidder, upon request by the Contracting Officer, shall submit a subcontracting plan, where applicable, which separately addresses subcontracting with small business concerns, with small disadvantaged business concerns and with women-owned small business concerns. If the bidder is submitting an individual contract plan, the plan must separately address subcontracting with small business concerns, small disadvantaged business concerns and women-owned small business concerns, with a separate part for the basic contract and separate parts for each option (if any). The plan shall be included in and made a part of the resultant contract. The subcontracting plan shall be submitted within the time specified by the Contracting Officer. Failure to submit the subcontracting plan shall make the bidder ineligible for the award of a contract.

(d) The offeror's subcontracting plan shall include the following:

(1) Goals, expressed in terms of percentages of total planned subcontracting dollars, for the use of small business concerns, small disadvantaged business concerns and women-owned small business concerns as subcontractors. The offeror shall include all subcontracts that contribute to contract performance, and may include a proportionate share of products and services that are normally allocated as indirect costs.

(2) A statement of--

(i) Total dollars planned to be subcontracted;

(ii) Total dollars planned to be subcontracted to small business concerns;

(iii) Total dollars planned to be subcontracted to small disadvantaged business concerns; and

(iv) Total dollars planned to be subcontracted to women-owned small business concerns.

(3) A description of the principal types of supplies and services to be subcontracted, and an identification of the types planned for subcontracting to (i) small business concerns, (ii) small disadvantaged business concerns and (iii) women-owned small business concerns.

(4) A description of the method used to develop the subcontracting goals in paragraph (d)(1) of this clause.

(5) A description of the method used to identify potential sources for solicitation purposes (e.g., existing company source lists, the Procurement Automated Source System (PASS) of the Small Business Administration, the National Minority Purchasing Council Vendor Information Service, the Research and Information Division of the Minority Business Development Agency in the Department of Commerce, or small, small disadvantaged and women-owned small business concerns trade associations). A firm may rely on the information contained in PASS as an accurate representation of a concern's size and ownership characteristics for purposes of maintaining a small business source list. A firm may rely on PASS as its small business source list. Use of the PASS as its source list does not relieve a firm of its responsibilities (e.g., outreach, assistance, counseling, publicizing subcontracting opportunities) in this clause.

(6) A statement as to whether or not the offeror included indirect costs in establishing subcontracting goals, and a description of the method used to determine the proportionate share of indirect costs to be incurred with (i) small business concerns, (ii) small disadvantaged business concerns, and (iii) women-owned small business concerns.

(7) The name of the individual employed by the offeror who will administer the offeror's subcontracting program, and a description of the duties of the individual.

(8) A description of the efforts the offeror will make to assure that small, small disadvantaged and women-owned small business concerns have an equitable opportunity to compete for subcontracts.

(9) Assurances that the offeror will include the clause in this contract entitled "Utilization of Small, Small Disadvantaged and Women-Owned Small Business Concerns" in all subcontracts that offer further subcontracting opportunities, and that the offeror will require all subcontractors (except small business concerns) who receive subcontracts in excess of \$500,000 (\$1,000,000 for construction of any public facility) to adopt a plan similar to the plan agreed to by the offeror.

(10) Assurances that the offeror will (i) cooperate in any studies or surveys as may be required, (ii) submit periodic reports in order to allow the Government to determine the extent of compliance by the offeror with the subcontracting plan, (iii) submit Standard Form (SF) 294, Subcontracting Report for Individual Contracts, and/or SF 295, Summary Subcontract Report, in accordance with the instructions on the forms, and (iv) ensure that its subcontractors agree to submit Standard Forms 294 and 295.

(11) A recitation of the types of records the offeror will maintain to demonstrate procedures that have been adopted to comply with the

requirements and goals in the plan, including establishing source lists; and a description of its efforts to locate small, small disadvantaged and women-owned small business concerns and award subcontracts to them. The records shall include at least the following (on a plant-wide or company-wide basis, unless otherwise indicated):

(i) Source lists (e.g., PASS), guides, and other data that identify small, small disadvantaged and women-owned small business concerns.

(ii) Organizations contacted in an attempt to locate sources that are small, small disadvantaged or women-owned small business concerns.

(iii) Records on each subcontract solicitation resulting in an award of more than \$100,000, indicating (A) whether small business concerns were solicited and if not, why not, (B) whether small disadvantaged business concerns were solicited and if not, why not, (C) whether women-owned small business concerns were solicited and if not, why not, and (D) if applicable, the reason award was not made to a small business concern.

(iv) Records of any outreach efforts to contact (A) trade associations, (B) business development organizations, and (C) conferences and trade fairs to locate small, small disadvantaged and women-owned small business sources.

(v) Records of internal guidance and encouragement provided to buyers through (A) workshops, seminars, training, etc., and (B) monitoring performance to evaluate compliance with the program's requirements.

(vi) On a contract-by-contract basis, records to support award data submitted by the offeror to the Government, including the name, address, and business size of each subcontractor. Contractors having company or division-wide annual plans need not comply with this requirement.

(e) In order to effectively implement this plan to the extent consistent with efficient contract performance, the Contractor shall perform the following functions:

(1) Assist small, small disadvantaged and women-owned small business concerns by arranging solicitations, time for the preparation of bids, quantities, specifications, and delivery schedules so as to facilitate the participation by such concerns. Where the contractor's lists of potential small, small disadvantaged and women-owned small business subcontractors are excessively long, reasonable effort shall be made to give all such small business concerns an opportunity to compete over a period of time.

(2) Provide adequate and timely consideration of the potentialities of small, small disadvantaged and women-owned small business concerns in all "make-or-buy" decisions.

(3) Counsel and discuss subcontracting opportunities with

representatives of small, small disadvantaged and women-owned small business firms.

(4) Provide notice to subcontractors concerning penalties and remedies for misrepresentations of business status as small, small disadvantaged or women-owned small business for the purpose of obtaining a subcontract that is to be included as part or all of a goal contained in the Contractor's subcontracting plan.

(f) A master subcontracting plan on a plant or division-wide basis which contains all the elements required by (d) above, except goals, may be incorporated by reference as a part of the subcontracting plan required of the offeror by this clause; provided, (1) the master plan has been approved, (2) the offeror provides copies of the approved master plan and evidence of its approval to the Contracting Officer, and (3) goals and any deviations from the master plan deemed necessary by the Contracting Officer to satisfy the requirements of this contract are set forth in the individual subcontracting plan.

(g)(1) If a commercial product is offered, the subcontracting plan required by this clause may relate to the offeror's production generally, for both commercial and noncommercial products, rather than solely to the Government contract. In these cases, the offeror shall, with the concurrence of the Contracting Officer, submit one company-wide or division-wide annual plan.

(2) The annual plan shall be reviewed for approval by the agency awarding the offeror its first prime contract requiring a subcontracting plan during the fiscal year, or by an agency satisfactory to the Contracting Officer.

(3) The approved plan shall remain in effect during the offeror's fiscal year for all of the offeror's commercial products.

(h) Prior compliance of the offeror with other such subcontracting plans under previous contracts will be considered by the Contracting Officer in determining the responsibility of the offeror for award of the contract.

(i) The failure of the Contractor or subcontractor to comply in good faith with (1) the clause of this contract entitled "Utilization Of Small, Small Disadvantaged and Women-Owned Small Business Concerns," or (2) an approved plan required by this clause, shall be a material breach of the contract.

(End of clause)

(a) "Failure to make a good faith effort to comply with the subcontracting plan," as used in this clause, means a willful or

intentional failure to perform in accordance with the requirements of the subcontracting plan approved under the clause in this contract entitled "Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan," or willful or intentional action to frustrate the plan.

(b) If, at contract completion, or in the case of a commercial product plan, at the close of the fiscal year for which the plan is applicable, the Contractor has failed to meet its subcontracting goals and the Contracting Officer decides in accordance with paragraph (c) of this clause that the Contractor failed to make a good faith effort to comply with its subcontracting plan, established in accordance with the clause in this contract entitled "Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan," the Contractor shall pay the Government liquidated damages in an amount stated. The amount of probable damages attributable to the Contractor's failure to comply, shall be an amount equal to the actual dollar amount by which the Contractor failed to achieve each subcontract goal or, in the case of a commercial products plan, that portion of the dollar amount allocable to Government contracts by which the Contractor failed to achieve each subcontract goal.

(c) Before the Contracting Officer makes a final decision that the Contractor has failed to make such good faith effort, the Contracting Officer shall give the Contractor written notice specifying the failure and permitting the Contractor to demonstrate what good faith efforts have been made. Failure to respond to the notice may be taken as an admission that no valid explanation exists. If, after consideration of all the pertinent data, the Contracting Officer finds that the Contractor failed to make a good faith effort to comply with the subcontracting plan, the Contracting Officer shall issue a final decision to that effect and require that the Contractor pay the Government liquidated damages as provided in paragraph (b) of this clause.

(d) With respect to commercial product plans; i.e., company-wide or division-wide subcontracting plans approved under paragraph (g) of the clause in this contract entitled "Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan," the Contracting Officer of the agency that originally approved the plan will exercise the functions of the Contracting Officer under this clause on behalf of all agencies that awarded contracts covered by that commercial product plan.

(e) The Contractor shall have the right of appeal, under the clause in this contract entitled, Disputes, from any final decision of the Contracting Officer.

(f) Liquidated damages shall be in addition to any other remedies that the Government may have.

(End of clause)

27 52.219-7003 SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS  
SUBCONTRACTING

PLAN (DoD CONTRACTS) (APR 1996)

This clause supplements the Federal Acquisition Regulation 52.219-9, Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan, clause of this contract.

(a) Definitions.

"Historically black colleges and universities," as used in this clause, means institutions determined by the Secretary of Education to meet the requirements of 34 CFR 608.2. The term also means any nonprofit research institution that was an integral part of such a college or university before November 14, 1986.

"Minority institutions," as used in this clause, means institutions meeting the requirements of section 1046(3) of the Higher Education Act of 1965 (20 U.S.C. 1135d-5(3)). The term also includes Hispanic-serving institutions as defined in section 316(b)(1) of such Act (20 U.S.C. 1059c(b)(1)).

(b) Except for company or division-wide commercial items subcontracting plans, the term "small disadvantaged business," when used in the FAR 52.219-9 clause, includes historically black colleges and universities and minority institutions, in addition to small disadvantaged business concerns.

(c) Work under the contract or its subcontracts shall be credited toward meeting the small disadvantaged business concern goal required by paragraph

(d) of the FAR 52.219-9 clause when:

(1) It is performed on Indian lands or in joint venture with an Indian tribe or a tribally-owned corporation, and

(2) It meets the requirements of 10 U.S.C. 2323a.

(d) Subcontracts awarded to workshops approved by the Committee for Purchase from People Who are Blind or Severely Disabled (41 U.S.C. 46-48), may be counted toward the Contractor's small business subcontracting goal.

(e) A mentor firm, under the Pilot Mentor-Protege Program established under Section 831 of Pub. L. 101-510, as amended, may count toward its small disadvantaged business goal, subcontracts awarded--

(1) Protege firms which are qualified organizations employing the severely handicapped; and

(2) Former protege firms that meet the criteria in Section 831(g)(4) of Pub. L. 101-510.

(f) The master plan approval referred to in paragraph (f) of the FAR 52.219-9 clause is approval by the Contractor's cognizant contract



administration activity.

(g) In those subcontracting plans which specifically identify small, small disadvantaged, and women-owned small businesses, the Contractor shall notify the Administrative Contracting Officer of any substitutions of firms that are not small, small disadvantaged, or women-owned small businesses for the firms listed in the subcontracting plan. Notifications shall be in writing and shall occur within a reasonable period of time after award of the subcontract. Contractor-specified formats shall be acceptable.

(End of clause)

28 52.222-1 NOTICE TO THE GOVERNMENT OF LABOR DISPUTES (APR 1984)

(a) If the Contractor has knowledge that any actual or potential labor dispute is delaying or threatens to delay the timely performance of this contract, the Contractor shall immediately give notice, including all relevant information, to the Contracting Officer.

(b) The Contractor agrees to insert the substance of this clause, including this paragraph (b), in any subcontract to which a labor dispute may delay the timely performance of this contract; except that each subcontract shall provide that in the event its timely performance is delayed or threatened by delay by any actual or potential labor dispute, the subcontractor shall immediately notify the next higher tier subcontractor or the prime Contractor, as the case may be, of all relevant information concerning the dispute.

(End of clause)

(R 7-203.27 1967 JUN)

(AV 7-104.4 1958 SEP)

(AV 7-603.1 1958 SEP)

29 52.222-3 CONVICT LABOR (AUG 1996)

The Contractor agrees not to employ in the performance of this contract any person undergoing a sentence of imprisonment which has been imposed by any court of a State, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, or the Trust Territory of the Pacific Islands. This limitation, however, shall not prohibit the employment by the Contractor in the performance of this contract of persons on parole or probation to work at paid employment during the term of their sentence or persons who have been pardoned or who have served their terms. Nor shall it prohibit the employment by the Contractor in the performance of this

contract of persons confined for violation of the laws of any of the States, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, or the Trust Territory of the Pacific Islands who are authorized to work at paid employment in the community under the laws of such jurisdiction, if--

(a)(1) The worker is paid or is in an approved work training program on a voluntary basis;

(2) Representatives of local union central bodies or similar labor union organizations have been consulted;

(3) Such paid employment will not result in the displacement of employed workers, or be applied in skills, crafts, or trades in which there is a surplus of available gainful labor in the locality, or impair existing contracts for services; and

(4) The rates of pay and other conditions of employment will not be less than those paid or provided for work of a similar nature in the locality in which the work is being performed; and

(b) The Attorney General of the United States has certified that the work-release laws or regulations of the jurisdiction involved are in conformity with the requirements of Executive Order 11755, as amended by Executive Orders 12608 and 12943.

(End of clause)

#### 30 52.222-4 CONTRACT WORK HOURS AND SAFETY STANDARDS ACT--OVERTIME COMPENSATION

(JUL 1995)

(a) Overtime requirements. No Contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics (see Federal Acquisition Regulation (FAR) 22.300) shall require or permit any such laborers or mechanics in any workweek in which the individual is employed on such work to work in excess of 40 hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than 1 1/2 times the basic rate of pay for all hours worked in excess of 40 hours in such workweek.

(b) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the provisions set forth in paragraph (a) of this clause, the Contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such Contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated

damages shall be computed with respect to each individual laborer or mechanic employed in violation of the provisions set forth in paragraph (a) of this clause in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of 40 hours without payment of the overtime wages required by provisions set forth in paragraph (a) of this clause.

(c) Withholding for unpaid wages and liquidated damages. The Contracting Officer shall upon his or her own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the Contractor or subcontractor under any such contract or any other Federal contract with the same Prime Contractor, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act which is held by the same Prime Contractor, such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for unpaid wages and liquidated damages as provided in the provisions set forth in paragraph (b) of this clause.

(d) Payrolls and basic records. (1) The Contractor or subcontractor shall maintain payrolls and basic payroll records during the course of contract work and shall preserve them for a period of 3 years from the completion of the contract for all laborers and mechanics working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Nothing in this paragraph shall require the duplication of records required to be maintained for construction work by Department of Labor regulations at 29 CFR 5.5(a)(3) implementing the Davis-Bacon Act.

(2) The records to be maintained under paragraph (d)(1) of this clause shall be made available by the Contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the Contracting Officer or the Department of Labor. The Contractor or subcontractor shall permit such representatives to interview employees during working hours on the job.

(e) Subcontracts. The Contractor or subcontractor shall insert in any subcontracts exceeding \$100,000, the provisions set forth in paragraphs (a) through (e) of this clause and also a clause requiring the subcontractors to include these provisions in any lower tier subcontracts. The Prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the provisions set forth in paragraphs (a) through (e) of this clause.

(End of clause)

(a) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR Part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (d) of this clause; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such period. Such laborers and mechanics shall be paid not less than the appropriate wage rate and fringe benefits in the wage determination for the classification of work actually performed, without regard to skill, except as provided in the clause entitled Apprentices and Trainees. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein; provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph (b) of this clause) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(b)(1) The Contracting Officer shall require that any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The Contracting Officer shall approve an additional classification and wage rate and fringe benefits therefor only when all the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination.

(ii) The classification is utilized in the area by the construction industry.

(iii) The proposed wage rate, including any bona fide fringe

benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(iv) With respect to helpers, such a classification prevails in the area in which the work is performed.

(2) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the Contracting Officer agree on the classification and wage rate (including the amount designated for fringe benefits, where appropriate), a report of the action taken shall be sent by the Contracting Officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator or an authorized representative will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(3) In the event the Contractor, the laborers or mechanics to be employed in the classification, or their representatives, and the Contracting Officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the Contracting Officer shall refer the questions, including the views of all interested parties and the recommendation of the Contracting Officer, to the Administrator of the Wage and Hour Division for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits, where appropriate) determined pursuant to subparagraphs (b)(2) and (b)(3) of this clause shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(c) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(d) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program; provided, that the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary

of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(End of clause)

32 52.222-7 WITHHOLDING OF FUNDS (FEB 1988)

The Contracting Officer shall, upon his or her own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the Contractor under this contract or any other Federal contract with the same Prime Contractor, or any other Federally assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same Prime Contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(End of clause)

33 52.222-8 PAYROLLS AND BASIC RECORDS (FEB 1988)

(a) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of 3 years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made, and actual wages paid. Whenever the Secretary of Labor has found, under paragraph (d) of the clause entitled Davis-Bacon Act, that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been

communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(b)(1) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Contracting Officer. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under paragraph (a) of this clause. This information may be submitted in any form desired. Optional Form WH-347 (Federal Stock Number 029-005-00014-1) is available for this purpose and may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. The Prime Contractor is responsible for the submission of copies of payrolls by all subcontractors.

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify--

(i) That the payroll for the payroll period contains the information required to be maintained under paragraph (a) of this clause and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in the Regulations, 29 CFR Part 3; and

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by subparagraph (b)(2) of this clause.

(4) The falsification of any of the certifications in this clause may subject the Contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 3729 of Title 31 of the United States Code.

(c) The Contractor or subcontractor shall make the records required under paragraph (a) of this clause available for inspection, copying, or transcription by the Contracting Officer or authorized representatives of the Contracting Officer or the Department of Labor. The Contractor or subcontractor shall permit the Contracting Officer or representatives of the Contracting Officer or the Department of Labor to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit required records or to make them available, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(End of clause)

34 52.222-9 APPRENTICES AND TRAINEES (FEB 1988)

(a) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in this paragraph, shall be paid not less than the applicable wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice



must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(b) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed in the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate in the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate in the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate in the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable

program is approved.

(c) Equal employment opportunity. The utilization of apprentices, trainees, and journeymen under this clause shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

(End of clause)

35 52.222-10 COMPLIANCE WITH COPELAND ACT REQUIREMENTS (FEB 1988)

The Contractor shall comply with the requirements of 29 CFR Part 3, which are hereby incorporated by reference in this contract.

(End of clause)

36 52.222-11 SUBCONTRACTS (LABOR STANDARDS) (FEB 1988)

(a) The Contractor or subcontractor shall insert in any subcontracts the clauses entitled Davis-Bacon Act, Contract Work Hours and Safety Standards Act--Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance with Copeland Act Requirements, Withholding of Funds, Subcontracts (Labor Standards), Contract Termination--Debarment, Disputes Concerning Labor Standards, Compliance with Davis-Bacon and Related Act Regulations, and Certification of Eligibility, and such other clauses as the Contracting Officer may, by appropriate instructions, require, and also a clause requiring subcontractors to include these clauses in any lower tier subcontracts. The Prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with all the contract clauses cited in this paragraph.

(b)(1) Within 14 days after award of the contract, the Contractor shall deliver to the Contracting Officer a completed Statement and Acknowledgment Form (SF 1413) for each subcontract, including the subcontractor's signed and dated acknowledgment that the clauses set forth in paragraph (a) of this clause have been included in the subcontract.

(2) Within 14 days after the award of any subsequently awarded subcontract the Contractor shall deliver to the Contracting Officer an updated completed SF 1413 for such additional subcontract.

(End of clause)

37 52.222-12 CONTRACT TERMINATION--DEBARMENT (FEB 1988)

A breach of the contract clauses entitled Davis-Bacon Act, Contract Work

Hours and Safety Standards Act--Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance with Copeland Act Requirements, Subcontracts (Labor Standards), Compliance with Davis-Bacon and Related Act Regulations, or Certification of Eligibility may be grounds for termination of the contract, and for debarment as a Contractor and subcontractor as provided in 29 CFR 5.12.

(End of clause)

38 52.222-13 COMPLIANCE WITH DAVIS-BACON AND RELATED ACT REGULATIONS (FEB 1988)

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are hereby incorporated by reference in this contract.

(End of clause)

39 52.222-14 DISPUTES CONCERNING LABOR STANDARDS (FEB 1988)

The United States Department of Labor has set forth in 29 CFR Parts 5, 6, and 7 procedures for resolving disputes concerning labor standards requirements. Such disputes shall be resolved in accordance with those procedures and not the Disputes clause of this contract. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees of their representatives.

(End of clause)

40 52.222-15 CERTIFICATION OF ELIGIBILITY (FEB 1988)

(a) By entering into this contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(b) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(c) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

(End of clause)

(a) If, during any 12-month period (including the 12 months preceding the award of this contract), the Contractor has been or is awarded nonexempt Federal contracts and/or subcontracts that have an aggregate value in excess of \$10,000, the Contractor shall comply with subparagraphs (b)(1) through (11) below. Upon request, the Contractor shall provide information necessary to determine the applicability of this clause.

(b) During performing this contract, the Contractor agrees as follows:

(1) The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin.

(2) The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. This shall include, but not be limited to, (i) employment, (ii) upgrading, (iii) demotion, (iv) transfer, (v) recruitment or recruitment advertising, (vi) layoff or termination, (vii) rates of pay or other forms of compensation, and (viii) selection for training, including apprenticeship.

(3) The Contractor shall post in conspicuous places available to employees and applicants for employment the notices to be provided by the Contracting Officer that explain this clause.

(4) The Contractor shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(5) The Contractor shall send, to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, the notice to be provided by the Contracting Officer advising the labor union or workers' representative of the Contractor's commitments under this clause, and post copies of the notice in conspicuous places available to employees and applicants for employment.

(6) The Contractor shall comply with Executive Order 11246, as amended, and the rules, regulations, and orders of the Secretary of Labor.

(7) The Contractor shall furnish to the contracting agency all information required by Executive Order 11246, as amended, and by the rules, regulations, and orders of the Secretary of Labor. Standard Form 100 (EEO-1), or any successor form, is the prescribed form to be filed within 30 days following the award, unless filed within 12 months

preceding the date of award.

(8) The Contractor shall permit access to its books, records, and accounts by the contracting agency or the Office of Federal Contract Compliance Programs (OFCCP) for the purposes of investigation to ascertain the Contractor's compliance with the applicable rules, regulations, and orders.

(9) If the OFCCP determines that the Contractor is not in compliance with this clause or any rule, regulation, or order of the Secretary of Labor, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts, under the procedures authorized in Executive Order 11246, as amended. In addition, sanctions may be imposed and remedies invoked against the Contractor as provided in Executive Order 11246, as amended, the rules, regulations, and orders of the Secretary of Labor, or as otherwise provided by law.

(10) The Contractor shall include the terms and conditions of subparagraph (b)(1) through (11) of this clause in every subcontract or purchase order that is not exempted by the rules, regulations, or orders of the Secretary of Labor issued under Executive Order 11246, as amended, so that these terms and conditions will be binding upon each subcontractor or vendor.

(11) The Contractor shall take such action with respect to any subcontract or purchase order as the contracting agency may direct as a means of enforcing these terms and conditions, including sanctions for noncompliance; provided, that if the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of any direction, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

(c) Notwithstanding any other clause in this contract, disputes relative to this clause will be governed by the procedures in 41 CFR 60-1.1.

(End of clause)

(R 7-103.18 1978 SEP)

(R 1-12.803-2)

(R 7-607.13 1978 SEP)

42 52.222-27 AFFIRMATIVE ACTION COMPLIANCE REQUIREMENTS FOR CONSTRUCTION (APR 1984)

(a) Definitions.

"Covered area," as used in this clause, means the geographical area described in the solicitation for this contract.

"Director," as used in this clause, means Director, Office of Federal Contract Compliance Programs (OFCCP), United States Department of Labor,

or any person to whom the Director delegates authority.

"Employer's identification number," as used in this clause, means the Federal Social Security number used on the employer's quarterly federal tax return, U.S. Treasury Department Form 941.

"Minority," as used in this clause, means--

(1) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

(2) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands);

(3) Black (all persons having origins in any of the black African racial groups not of Hispanic origin); and

(4) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race).

(b) If the Contractor, or a subcontractor at any tier, subcontracts a portion of the work involving any construction trade, each such subcontract in excess of \$10,000 shall include this clause and the Notice containing the goals for minority and female participation stated in the solicitation for this contract.

(c) If the Contractor is participating in a Hometown Plan (41 CFR 60-4) approved by the U.S. Department of Labor in a covered area, either individually or through an association, its affirmative action obligations on all work in the plan area (including goals) shall comply with the plan for those trades that have unions participating in the plan. Contractors must be able to demonstrate participation in, and compliance with, the provisions of the plan. Each Contractor or subcontractor participating in an approved plan is also required to comply with its obligations under the Equal Opportunity clause, and to make a good faith effort to achieve each goal under the plan in each trade in which it has employees. The overall good-faith performance by other Contractors or subcontractors toward a goal in an approved plan does not excuse any Contractor's or subcontractor's failure to make good-faith efforts to achieve the plan's goals.

(d) The Contractor shall implement the affirmative action procedures in subparagraphs (g)(1) through (16) of this clause. The goals stated in the solicitation for this contract are expressed as percentages of the total hours of employment and training of minority and female utilization that the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for the geographical

area where that work is actually performed. The Contractor is expected to make substantially uniform progress toward its goals in each craft.

(e) Neither the terms and conditions of any collective bargaining agreement, nor the failure by a union with which the Contractor has a collective bargaining agreement, to refer minorities or women shall excuse the Contractor's obligations under this clause, Executive Order 11246, as amended, or the regulations thereunder.

(f) In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

(g) The Contractor shall take affirmative action to ensure equal employment opportunity. The evaluation of the Contractor's compliance with this clause shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully and implement affirmative action steps at least as extensive as the following:

(1) Ensure a working environment free of harassment, intimidation, and coercion at all sites and in all facilities where the Contractor's employees are assigned to work. The Contractor, if possible, will assign two or more women to each construction project. The Contractor shall ensure that foremen, superintendents, and other onsite supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at these sites or facilities.

(2) Establish and maintain a current list of sources for minority and female recruitment. Provide written notification to minority and female recruitment sources and community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

(3) Establish and maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant, referrals of minorities or females from unions, recruitment sources, or community organizations, and the action taken with respect to each individual. If an individual was sent to the union hiring hall for referral and not referred back to the Contractor by the union or, if referred back, not employed by the Contractor, this shall be documented in the file, along with whatever additional actions the Contractor may have taken.

(4) Immediately notify the Director when the union or unions with which the Contractor has a collective bargaining agreement has not

referred back to the Contractor a minority or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

(5) Develop on-the-job training opportunities and/or participate in training programs for the area that expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under subparagraph (g)(2) above.

(6) Disseminate the Contractor's equal employment policy by--

(i) Providing notice of the policy to unions and to training, recruitment, and outreach programs, and requesting their cooperation in assisting the Contractor in meeting its contract obligations;

(ii) Including the policy in any policy manual and in collective bargaining agreements;

(iii) Publicizing the policy in the company newspaper, annual report, etc.;

(iv) Reviewing the policy with all management personnel and with all minority and female employees at least once a year; and

(v) Posting the policy on bulletin boards accessible to employees at each location where construction work is performed.

(7) Review, at least annually, the Contractor's equal employment policy and affirmative action obligations with all employees having responsibility for hiring, assignment, layoff, termination, or other employment decisions. Conduct review of this policy with all onsite supervisory personnel before initiating construction work at a job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

(8) Disseminate the Contractor's equal employment policy externally by including it in any advertising in the news media, specifically including minority and female news media. Provide written notification to, and discuss this policy with, other Contractors and subcontractors with which the Contractor does or anticipates doing business.

(9) Direct recruitment efforts, both oral and written, to minority, female, and community organizations, to schools with minority and female students, and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than 1 month before the date for acceptance of applications for apprenticeship or training by any recruitment source, send written notification to organizations such as the above, describing



the openings, screening procedures, and tests to be used in the selection process.

(10) Encourage present minority and female employees to recruit minority persons and women. Where reasonable, provide after-school, summer, and vacation employment to minority and female youth both on the site and in other areas of the Contractor's workforce.

(11) Validate all tests and other selection requirements where required under 41 CFR 60-3.

(12) Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities. Encourage these employees to seek or to prepare for, through appropriate training, etc., opportunities for promotion.

(13) Ensure that seniority practices job classifications, work assignments, and other personnel practices do not have a discriminatory effect by continually monitoring all personnel and employment-related activities to ensure that the Contractor's obligations under this contract are being carried out.

(14) Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

(15) Maintain a record of solicitations for subcontracts for minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

(16) Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's equal employment policy and affirmative action obligations.

(h) The Contractor is encouraged to participate in voluntary associations that may assist in fulfilling one or more of the affirmative action obligations contained in subparagraphs (g)(1) through (16). The efforts of a contractor association, joint contractor-union, contractor-community, or similar group of which the contractor is a member and participant may be asserted as fulfilling one or more of its obligations under subparagraphs (g)(1) through (16), provided the Contractor--

(1) Actively participates in the group;

(2) Makes every effort to ensure that the group has a positive impact on the employment of minorities and women in the industry;

(3) Ensures that concrete benefits of the program are reflected in the Contractor's minority and female workforce participation;

(4) Makes a good-faith effort to meet its individual goals and timetables; and

(5) Can provide access to documentation that demonstrates the

effectiveness of actions taken on behalf of the Contractor. The obligation to comply is the Contractor's, and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

(i) A single goal for minorities and a separate single goal for women shall be established. The Contractor is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and nonminority. Consequently, the Contractor may be in violation of Executive Order 11246, as amended, if a particular group is employed in a substantially disparate manner.

(j) The Contractor shall not use goals or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

(k) The Contractor shall not enter into any subcontract with any person or firm debarred from Government contracts under Executive Order 11246, as amended.

(l) The Contractor shall carry out such sanctions and penalties for violation of this clause and of the Equal Opportunity clause, including suspension, termination, and cancellation of existing subcontracts, as may be imposed or ordered under Executive Order 11246, as amended, and its implementing regulations, by the OFCCP. Any failure to carry out these sanctions and penalties as ordered shall be a violation of this clause and Executive Order 11246, as amended.

(m) The Contractor in fulfilling its obligations under this clause shall implement affirmative action procedures at least as extensive as those prescribed in paragraph (g) above, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of Executive Order 11246, as amended, the implementing regulations, or this clause, the Director shall take action as prescribed in 41 CFR 60-4.8.

(n) The Contractor shall designate a responsible official to--

(1) Monitor all employment-related activity to ensure that the Contractor's equal employment policy is being carried out;

(2) Submit reports as may be required by the Government; and

(3) Keep records that shall at least include for each employee the name, address, telephone number, construction trade, union affiliation (if any), employee identification number, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this

requirement, separate records are not required to be maintained.

(o) Nothing contained herein shall be construed as a limitation upon the application of other laws that establish different standards of compliance or upon the requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

(End of clause)

(R 7-603.60 1978 SEP)

#### 43 52.222-35 AFFIRMATIVE ACTION FOR SPECIAL DISABLED AND VIETNAM ERA VETERANS

(APR 1984)

(a) Definitions.

"Appropriate office of the State employment service system," as used in this clause, means the local office of the Federal-State national system of public employment offices assigned to serve the area where the employment opening is to be filled, including the District of Columbia, Guam, Puerto Rico, Virgin Islands, American Samoa, and the Trust Territory of the Pacific Islands.

"Openings that the Contractor proposes to fill from within its own organization," as used in this clause, means employment openings for which no one outside the Contractor's organization (including any affiliates, subsidiaries, and the parent companies) will be considered and includes any openings that the Contractor proposes to fill from regularly established "recall" lists.

"Openings that the Contractor proposes to fill under a customary and traditional employer-union hiring arrangement," as used in this clause, means employment openings that the Contractor proposes to fill from union halls, under their customary and traditional employer-union hiring relationship.

"Suitable employment openings," as used in this clause--

(1) Includes, but is not limited to, openings that occur in jobs categorized as--

(i) Production and nonproduction;

(ii) Plant and office;

(iii) Laborers and mechanics;

(iv) Supervisory and nonsupervisory;

(v) Technical; and

(vi) Executive, administrative, and professional positions

compensated on a salary basis of less than \$25,000 a year; and

(2) Includes full-time employment, temporary employment of over 3

days, and part-time employment, but not openings that the Contractor proposes to fill from within its own organization or under a customary and traditional employer-union hiring arrangement, nor openings in an educational institution that are restricted to students of that institution.

(b) General. (1) Regarding any position for which the employee or applicant for employment is qualified, the Contractor shall not discriminate against the individual because the individual is a special disabled or Vietnam Era veteran. The Contractor agrees to take affirmative action to employ, advance in employment, and otherwise treat qualified special disabled and Vietnam Era veterans without discrimination based upon their disability or veterans' status in all employment practices such as--

- (i) Employment;
- (ii) Upgrading;
- (iii) Demotion or transfer;
- (iv) Recruitment;
- (v) Advertising;
- (vi) Layoff or termination;
- (vii) Rates of pay or other forms of compensation; and
- (viii) Selection for training, including apprenticeship.

(2) The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor (Secretary) issued under the Vietnam Era Veterans' Readjustment Assistance Act of 1972 (the Act), as amended.

(c) Listing openings. (1) The Contractor agrees to list all suitable employment openings existing at contract award or occurring during contract performance, at an appropriate office of the State employment service system in the locality where the opening occurs. These openings include those occurring at any Contractor facility, including one not connected with performing this contract. An independent corporate affiliate is exempt from this requirement.

(2) State and local government agencies holding Federal contracts of \$10,000 or more shall also list all their suitable openings with the appropriate office of the State employment service.

(3) The listing of suitable employment openings with the State employment service system is required at least concurrently with using any other recruitment source or effort and involves the obligations of placing a bona fide job order, including accepting referrals of veterans and nonveterans. This listing does not require hiring any particular job applicant or hiring from any particular group of job applicants and is not intended to relieve the Contractor from any requirements of Executive orders or regulations concerning nondiscrimination in employment.

(4) Whenever the Contractor becomes contractually bound to the listing terms of this clause, it shall advise the State employment service system, in each State where it has establishments, of the name and location of each hiring location in the State. As long as the Contractor is contractually bound to these terms and has so advised the State system, it need not advise the State system of subsequent contracts. The Contractor may advise the State system when it is no longer bound by this contract clause.

(5) Under the most compelling circumstances, an employment opening may not be suitable for listing, including situations when (i) the Government's needs cannot reasonably be supplied, (ii) listing would be contrary to national security, or (iii) the requirement of listing would not be in the Government's interest.

(d) Applicability. (1) This clause does not apply to the listing of employment openings which occur and are filled outside the 50 States, the District of Columbia, Puerto Rico, Guam, Virgin Islands, American Samoa, and the Trust Territory of the Pacific Islands.

(2) The terms of paragraph (c) above of this clause do not apply to openings that the Contractor proposes to fill from within its own organization or under a customary and traditional employer-union hiring arrangement. This exclusion does not apply to a particular opening once an employer decides to consider applicants outside of its own organization or employer-union arrangement for that opening.

(e) Postings. (1) The Contractor agrees to post employment notices stating (i) the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified special disabled veterans and veterans of the Vietnam era, and (ii) the rights of applicants and employees.

(2) These notices shall be posted in conspicuous places that are available to employees and applicants for employment. They shall be in a form prescribed by the Director, Office of Federal Contract Compliance Programs, Department of Labor (Director), and provided by or through the Contracting Officer.

(3) The Contractor shall notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of the Act, and is committed to take affirmative action to employ, and advance in employment, qualified special disabled and Vietnam Era veterans.

(f) Noncompliance. If the Contractor does not comply with the requirements of this clause, appropriate actions may be taken under the rules, regulations, and relevant orders of the Secretary issued pursuant to the Act.

(g) Subcontracts. The Contractor shall include the terms of this

clause in every subcontract or purchase order of \$10,000 or more unless exempted by rules, regulations, or orders of the Secretary. The Contractor shall act as specified by the Director to enforce the terms, including action for noncompliance.

(End of clause)

(R 7-103.27 1976 JUL)

(R FPR Temp. Reg. 39)

44 52.222-36 AFFIRMATIVE ACTION FOR HANDICAPPED WORKERS (APR 1984)

(a) General. (1) Regarding any position for which the employee or applicant for employment is qualified, the Contractor shall not discriminate against any employee or applicant because of physical or mental handicap. The Contractor agrees to take affirmative action to employ, advance in employment, and otherwise treat qualified handicapped individuals without discrimination based upon their physical or mental handicap in all employment practices such as--

- (i) Employment;
- (ii) Upgrading;
- (iii) Demotion or transfer;
- (iv) Recruitment;
- (v) Advertising;
- (vi) Layoff or termination;
- (vii) Rates of pay or other forms of compensation; and
- (viii) Selection for training, including apprenticeship.

(2) The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor (Secretary) issued under the Rehabilitation Act of 1973 (29 U.S.C. 793) (the Act), as amended.

(b) Postings. (1) The Contractor agrees to post employment notices stating (i) the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified handicapped individuals and (ii) the rights of applicants and employees.

(2) These notices shall be posted in conspicuous places that are available to employees and applicants for employment. They shall be in a form prescribed by the Director, Office of Federal Contract Compliance Programs, Department of Labor (Director), and provided by or through the Contracting Officer.

(3) The Contractor shall notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of Section 503 of the Act and is committed to take affirmative action to employ, and advance in employment, qualified physically and mentally

handicapped individuals.

(c) Noncompliance. If the Contractor does not comply with the requirements of this clause, appropriate actions may be taken under the rules, regulations, and relevant orders of the Secretary issued pursuant to the Act.

(d) Subcontracts. The Contractor shall include the terms of this clause in every subcontract or purchase order in excess of \$2,500 unless exempted by rules, regulations, or orders of the Secretary. The Contractor shall act as specified by the Director to enforce the terms, including action for noncompliance.

(End of clause)

(R 7-103.28 1976 MAY)

(R FPR Temp. Reg. 38)

45 52.222-37 EMPLOYMENT REPORTS ON SPECIAL DISABLED VETERANS AND VETERANS OF THE  
VIETNAM ERA (JAN 1988)

(a) The contractor shall report at least annually, as required by the Secretary of Labor, on:

(1) The number of special disabled veterans and the number of veterans of the Vietnam era in the workforce of the contractor by job category and hiring location; and

(2) The total number of new employees hired during the period covered by the report, and of that total, the number of special disabled veterans, and the number of veterans of the Vietnam era.

(b) The above items shall be reported by completing the form entitled "Federal Contractor Veterans' Employment Report VETS-100."

(c) Reports shall be submitted no later than March 31 of each year beginning March 31, 1988.

(d) The employment activity report required by paragraph (a)(2) of this clause shall reflect total hires during the most recent 12-month period as of the ending date selected for the employment profile report required by paragraph (a)(1) of this clause. Contractors may select an ending date:

(1) As of the end of any pay period during the period January through March 1st of the year the report is due, or (2) as of December 31, if the contractor has previous written approval from the Equal Employment Opportunity Commission to do so for purposes of submitting the Employer Information Report EEO-1 (Standard Form 100).

(e) The count of veterans reported according to paragraph (a) of this clause shall be based on voluntary disclosure. Each contractor subject to the reporting requirements at 38 U.S.C. 2012(d) shall invite all special

disabled veterans and veterans of the Vietnam era who wish to benefit under the affirmative action program at 38 U.S.C. 2012 to identify themselves to the contractor. The invitation shall state that the information is voluntarily provided, that the information will be kept confidential, that disclosure or refusal to provide the information will not subject the applicant or employee to any adverse treatment and that the information will be used only in accordance with the regulations promulgated under 38 U.S.C. 2012.

(f) Subcontracts. The Contractor shall include the terms of this clause in every subcontract or purchase order of \$10,000 or more unless exempted by rules, regulations, or orders of the Secretary.

(End of clause)

46 52.223-2 CLEAN AIR AND WATER (APR 1984)

(a) "Air Act", as used in this clause, means the Clean Air Act (42 U.S.C. 7401, et seq.).

"Clean air standards," as used in this clause, means--

- (1) Any enforceable rules, regulations, guidelines, standards, limitations, orders, controls, prohibitions, work practices, or other requirements contained in, issued under, or otherwise adopted under the Air Act or Executive Order 11738;
- (2) An applicable implementation plan as described in section 110(d) of the Air Act (42 U.S.C. 7410(d));
- (3) An approved implementation procedure or plan under section 111(c) or section 111(d) of the Air Act (42 U.S.C. 7411(c) or (d)); or
- (4) An approved implementation procedure under section 112(d) of the Air Act (42 U.S.C. 7412(d)).

"Clean water standards," as used in this clause, means any enforceable limitation, control, condition, prohibition, standard, or other requirement promulgated under the Water Act or contained in a permit issued to a discharger by the EPA or by a State under an approved program, as authorized by section 402 of the Water Act (33 U.S.C. 1342), or by local government to ensure compliance with pretreatment regulations as required by section 307 of the Water Act (33 U.S.C. 1317).

"Compliance," as used in this clause, means compliance with--

- (1) Clean air or water standards; or
- (2) A schedule or plan ordered or approved by a court of competent jurisdiction, the EPA, or an air or water pollution control agency under the requirements of the Air Act or Water Act and related regulations.

"Facility," as used in this clause, means any building, plant, installation, structure, mine, vessel or other floating craft, location, or



site of operations, owned, leased, or supervised by a Contractor or subcontractor, used in the performance of a contract or subcontract. When a location or site of operations includes more than one building, plant, installation, or structure, the entire location or site shall be deemed a facility except when the Administrator, or a designee, of the EPA determines that independent facilities are collocated in one geographical area.

"Water Act," as used in this clause, means Clean Water Act (33 U.S.C. 1251, et seq.).

(b) The Contractor agrees--

(1) To comply with all the requirements of section 114 of the Clean Air Act (42 U.S.C. 7414) and section 308 of the Clean Water Act (33 U.S.C. 1318) relating to inspection, monitoring, entry, reports, and information, as well as other requirements specified in section 114 and section 308 of the Air Act and the Water Act, and all regulations and guidelines issued to implement those acts before the award of this contract;

(2) That no portion of the work required by this prime contract will be performed in a facility listed on the EPA List of Violating Facilities on the date when this contract was awarded unless and until the EPA eliminates the name of the facility from the listing;

(3) To use best efforts to comply with clean air standards and clean water standards at the facility in which the contract is being performed; and

(4) To insert the substance of this clause into any nonexempt subcontract, including this subparagraph (b)(4).

(End of clause)

(R 7-103.29 1975 OCT)

(R 1-1.2302)

#### 47 52.223-3 HAZARDOUS MATERIAL IDENTIFICATION AND MATERIAL SAFETY DATA (NOV 1991)

(a) "Hazardous material," as used in this clause, includes any material defined as hazardous under the latest version of Federal Standard No. 313 (including revisions adopted during the term of the contract).

(b) The Offeror must list any hazardous material, as defined in paragraph (a) of this clause, to be delivered under this contract. The hazardous material shall be properly identified and include any applicable identification number, such as National Stock Number or Special Item Number. This information shall also be included on the Material Safety Data Sheet submitted under this contract.

Material

Identification No.

(If none, insert None)


(c) The apparently successful Offeror, by acceptance of the contract, certifies that the list in paragraph (b) of this clause is complete. This list must be updated during performance of the contract whenever the Contractor determines that any other material to be delivered under this contract is hazardous.

(d) The apparently successful Offeror agrees to submit, for each item as required prior to award, a Material Safety Data Sheet, meeting the requirements of 29 CFR 1910.1200(g) and the latest version of Federal Standard No. 313, for all hazardous material identified in paragraph (b) of this clause. Data shall be submitted in accordance with Federal Standard No. 313, whether or not the apparently successful Offeror is the actual manufacturer of these items. Failure to submit the Material Safety Data Sheet prior to award may result in the apparently successful Offeror being considered nonresponsible and ineligible for award.

(e) If, after award, there is a change in the composition of the item(s) or a revision to Federal Standard No. 313, which renders incomplete or inaccurate the data submitted under paragraph (d) of this clause or the certification submitted under paragraph (c) of this clause, the Contractor shall promptly notify the Contracting Officer and resubmit the data.

(f) Neither the requirements of this clause nor any act or failure to act by the Government shall relieve the Contractor of any responsibility or liability for the safety of Government, Contractor, or subcontractor personnel or property.

(g) Nothing contained in this clause shall relieve the Contractor from complying with applicable Federal, State, and local laws, codes, ordinances, and regulations (including the obtaining of licenses and permits) in connection with hazardous material.

(h) The Government's rights in data furnished under this contract with respect to hazardous material are as follows:

(1) To use, duplicate and disclose any data to which this clause is applicable. The purposes of this right are to--

(i) Apprise personnel of the hazards to which they may be exposed in using, handling, packaging, transporting, or disposing of hazardous materials;

(ii) Obtain medical treatment for those affected by the material;

and

(iii) Have others use, duplicate, and disclose the data for the Government for these purposes.

(2) To use, duplicate, and disclose data furnished under this clause,

in accordance with subparagraph (h)(1) of this clause, in precedence over any other clause of this contract providing for rights in data.

(3) The Government is not precluded from using similar or data acquired from other sources.

(End of clause)

48 52.223-6 DRUG-FREE WORKPLACE (JUL 1990)

(a) Definitions. As used in this clause,

"Controlled substance" means a controlled substance in schedules I through V of section 202 of the Controlled Substances Act (21 U.S.C. 812) and as further defined in regulation at 21 CFR 1308.11 - 1308.15.

"Conviction" means a finding of guilt (including a plea of nolo contendere) or imposition of sentence, or both, by any judicial body charged with the responsibility to determine violations of the Federal or State criminal drug statutes.

"Criminal drug statute" means a Federal or non-Federal criminal statute involving the manufacture, distribution, dispensing, possession or use of any controlled substance.

"Drug-free workplace" means the site(s) for the performance of work done by the Contractor in connection with a specific contract at which employees of the Contractor are prohibited from engaging in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance.

"Employee" means an employee of a Contractor directly engaged in the performance of work under a Government contract. "Directly engaged" is defined to include all direct cost employees and any other Contractor employee who has other than a minimal impact or involvement in contract performance.

"Individual" means an offeror/contractor that has no more than one employee including the offeror/contractor.

(b) The Contractor, if other than an individual, shall--within 30 calendar days after award (unless a longer period is agreed to in writing for contracts of 30 calendar days or more performance duration), or as soon as possible for contracts of less than 30 calendar days performance duration--

(1) Publish a statement notifying its employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the Contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition;

(2) Establish an ongoing drug-free awareness program to inform such employees about--

- (i) The dangers of drug abuse in the workplace;
  - (ii) The Contractor's policy of maintaining a drug-free workplace;
  - (iii) Any available drug counseling, rehabilitation, and employee assistance programs; and
  - (iv) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace;
- (3) Provide all employees engaged in performance of the contract with a copy of the statement required by subparagraph (b)(1) of this clause;
- (4) Notify such employees in writing in the statement required by subparagraph (b)(1) of this clause that, as a condition of continued employment on this contract, the employee will--
- (i) Abide by the terms of the statement; and
  - (ii) Notify the employer in writing of the employee's conviction under a criminal drug statute for a violation occurring in the workplace no later than 5 calendar days after such conviction.
- (5) Notify the Contracting Officer in writing within 10 calendar days after receiving notice under subdivision (b)(4)(ii) of this clause, from an employee or otherwise receiving actual notice of such conviction. The notice shall include the position title of the employee;
- (6) Within 30 calendar days after receiving notice under subdivision (b)(4)(ii) of this clause of a conviction, take one of the following actions with respect to any employee who is convicted of a drug abuse violation occurring in the workplace:
- (i) Taking appropriate personnel action against such employee, up to and including termination; or
  - (ii) Require such employee to satisfactorily participate in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency.
- (7) Make a good faith effort to maintain a drug-free workplace through implementation of subparagraphs (b)(1) through (b)(6) of this clause.
- (c) The Contractor, if an individual, agrees by award of the contract or acceptance of a purchase order, not to engage in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance in the performance of this contract.
- (d) In addition to other remedies available to the Government, the Contractor's failure to comply with the requirements of paragraphs (b) or (c) of this clause may, pursuant to FAR 23.506, render the Contractor subject to suspension of contract payments, termination of the contract for default, and suspension or debarment.

(End of clause)

(a) Unless otherwise exempt, the Contractor, as owner or operator of a facility used in the performance of this contract, shall file by July 1 for the prior calendar year an annual Toxic Chemical Release Inventory Form (Form R) as described in sections 313(a) and (g) of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023(a) and (g)), and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106). The Contractor shall file, for each facility subject to the Form R filing and reporting requirements, the annual Form R throughout the life of the contract.

(b) A Contractor owned or operated facility used in the performance of this contract is exempt from the requirement to file an annual Form R if--

(1) The facility does not manufacture, process, or otherwise use any toxic chemicals listed under section 313(c) of EPCRA, 42 U.S.C. 11023(c);

(2) The facility does not have 10 or more full-time employees as specified in section 313(b)(1)(A) of EPCRA, 42 U.S.C. 11023(b)(1)(A);

(3) The facility does not meet the reporting thresholds of toxic chemicals established under section 313(f) of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been filed with EPA);

(4) The facility does not fall within Standard Industrial Classification Code (SIC) designations 20 through 39 as set forth in Section 19.102 of the Federal Acquisition Regulation (FAR); or

(5) The facility is not located within any State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the United States Virgin Islands, the Northern Mariana Islands, or any other territory or possession over which the United States has jurisdiction.

(c) If the Contractor has certified to an exemption in accordance with one or more of the criteria in paragraph (b) of this clause, and after award of the contract circumstances change so that any of its owned or operated facilities used in the performance of this contract is no longer exempt--

(1) The Contractor shall notify the Contracting Officer; and

(2) The Contractor, as owner or operator of a facility used in the performance of this contract that is no longer exempt, shall (i) submit a Toxic Chemical Release Inventory Form (Form R) on or before July 1 for the prior calendar year during which the facility becomes eligible; and (ii) continue to file the annual Form R for the life of the contract for such facility.

(d) The Contracting Officer may terminate this contract or take other

action as appropriate, if the Contractor fails to comply accurately and fully with the EPCRA and PPA toxic chemical release filing and reporting requirements.

(e) Except for acquisitions of commercial items as defined in FAR Part 2, the Contractor shall--

(1) For competitive subcontracts expected to exceed \$100,000 (including all options), include a solicitation provision substantially the same as the provision at FAR 52.223-13, Certification of Toxic Chemical Release Reporting; and

(2) Include in any resultant subcontract exceeding \$100,000 (including all options), the substance of this clause, except this paragraph (e).

(End of clause)

50 52.223-7001 HAZARD WARNING LABELS (DEC 1991)

(a) "Hazardous material," as used in this clause, is defined in the Hazardous Material Identification and Material Safety Data clause of this contract.

(b) The Contractor shall label the item package (unit container) of any hazardous material to be delivered under this contract in accordance with the Hazard Communication Standard (29 CFR 1910.1200 et seq.). The Standard requires that the hazard warning label conform to the requirements of the standard unless the material is otherwise subject to the labelling requirements of one of the following statutes:

- (1) Federal Insecticide, Fungicide and Rodenticide Act;
- (2) Federal Food, Drug and Cosmetics Act;
- (3) Consumer Product Safety Act;
- (4) Federal Hazardous Substances Act; or
- (5) Federal Alcohol Administration Act.

(c) The Offeror shall list which hazardous material listed in the Hazardous Material Identification and Material Safety Data clause of this contract will be labelled in accordance with one of the Acts in paragraphs (b)(1) through (5) of this clause instead of the Hazard Communication Standard. Any hazardous material not listed will be interpreted to mean that a label is required in accordance with the Hazard Communication Standard.

Material (if none, insert "none.")	Act

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(d) The apparently successful Offeror agrees to submit, before award, a copy of the hazard warning label for all hazardous materials not listed in paragraph (c) of this clause. The Offeror shall submit the label with the Material Safety Data Sheet being furnished under the Hazardous Material Identification and Material Safety Data clause of this contract.

(e) The Contractor shall also comply with MIL-STD-129, Marking for Shipment and Storage (including revisions adopted during the term of this contract).

(End of clause)

51 52.223-7004 DRUG-FREE WORK FORCE (SEP 1988)

(a) Definitions.

(1) "Employee in a sensitive position," as used in this clause, means an employee who has been granted access to classified information; or employees in other positions that the Contractor determines involve national security, health or safety, or functions other than the foregoing requiring a high degree of trust and confidence.

(2) "Illegal drugs," as used in this clause, means controlled substances included in Schedules I and II, as defined by section 802(6) of Title 21 of the United States Code, the possession of which is unlawful under Chapter 13 of that Title. The term "illegal drugs" does not mean the use of a controlled substance pursuant to a valid prescription or other uses authorized by law.

(b) The Contractor agrees to institute and maintain a program for achieving the objective of a drug-free work force. While this clause defines criteria for such a program, contractors are encouraged to implement alternative approaches comparable to the criteria in paragraph (c) that are designed to achieve the objectives of this clause.

(c) Contractor programs shall include the following, or appropriate alternatives:

(1) Employee assistance programs emphasizing high level direction, education, counseling, rehabilitation, and coordination with available community resources;

(2) Supervisory training to assist in identifying and addressing illegal drug use by Contractor employees;

(3) Provision for self-referrals as well as supervisory referrals to treatment with maximum respect for individual confidentiality consistent with safety and security issues;

(4) Provision for identifying illegal drug users, including testing on a controlled and carefully monitored basis. Employee drug testing

programs shall be established taking account of the following:

(i) The Contractor shall establish a program that provides for testing for the use of illegal drugs by employees in sensitive positions. The extent of and criteria for such testing shall be determined by the Contractor based on considerations that include the nature of the work being performed under the contract, the employee's duties, the efficient use of Contractor resources, and the risks to health, safety, or national security that could result from the failure of an employee adequately to discharge his or her position.

(ii) In addition, the Contractor may establish a program for employee drug testing--

(A) When there is a reasonable suspicion that an employee uses illegal drugs; or

(B) When an employee has been involved in an accident or unsafe practice;

(C) As part of or as a follow-up to counseling or rehabilitation for illegal drug use;

(D) As part of a voluntary employee drug testing program.

(iii) The Contractor may establish a program to test applicants for employment for illegal drug use.

(iv) For the purpose of administering this clause, testing for illegal drugs may be limited to those substances for which testing is prescribed by section 2.1 of Subpart B of the "Mandatory Guidelines for Federal Workplace Drug Testing Programs" (53 FR 11980 (April 11 1988)), issued by the Department of Health and Human Services.

(d) Contractors shall adopt appropriate personnel procedures to deal with employees who are found to be using drugs illegally. Contractors shall not allow any employee to remain on duty or perform in a sensitive position who is found to use illegal drugs until such time as the Contractor, in accordance with procedures established by the Contractor, determines that the employee may perform in such a position.

(e) The provisions of this clause pertaining to drug testing programs shall not apply to the extent they are inconsistent with state or local law, or with an existing collective bargaining agreement; provided that with respect to the latter, the Contractor agrees that those issues that are in conflict will be a subject of negotiation at the next collective bargaining session.

(End of clause)



1993)

(a) Definitions. As used in this clause--

(1) "Storage" means a non-transitory, semi-permanent or permanent holding, placement, or leaving of material. It does not include a temporary accumulation of a limited quantity of a material used in or a waste generated or resulting from authorized activities, such as servicing, maintenance, or repair of Department of Defense (DoD) items, equipment, or facilities.

(2) "Toxic or hazardous materials" means:

(i) Materials referred to in section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (42 U.S.C. 9601(14)) and materials designated under section 102 of CERCLA (42 U.S.C. 9602)(40 CFR Part 302);

(ii) Materials that are of an explosive, flammable, or pyrotechnic nature; or

(iii) Materials otherwise identified by the Secretary of Defense as specified in DoD regulations.

(b) In accordance with 10 U.S.C. 2692, the Contractor is prohibited from storing or disposing of non-DoD-owned toxic or hazardous materials on a DoD installation, except to the extent authorized by a statutory exception to 10 U.S.C. 2692 or as authorized by the Secretary of Defense or his designee.

(End of clause)

53 52.225-5 BUY AMERICAN ACT--CONSTRUCTION MATERIALS (MAY 1992)

(a) The Buy American Act (41 U.S.C. 10) provides that the Government give preference to domestic construction material.

"Components," as used in this clause, means those articles, materials, and supplies incorporated directly into construction materials.

"Construction materials," as used in this clause, means an article, material, or supply brought to the construction site for incorporation into the building or work. Construction material also includes an item brought to the site pre-assembled from articles, materials or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, which are discrete systems incorporated into a public building or work and which are produced as a complete system, shall be evaluated as a single and distinct construction material regardless of when or how the individual parts or components of such systems are delivered to the construction site.

"Domestic construction material," as used in this clause, means (1) an

unmanufactured construction material mined or produced in the United States, or (2) a construction material manufactured in the United States, if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind as the construction materials determined to be unavailable pursuant to subparagraph 25.202(a)(3) of the Federal Acquisition Regulation (FAR) shall be treated as domestic.

(b) The Contractor agrees that only domestic construction material will be used by the Contractor, subcontractors, materialmen, and suppliers in the performance of this contract, except for foreign construction materials, if any, listed in this contract. (The foregoing requirements are administered in accordance with Executive Order No. 10582, dated December 17, 1954, as amended, and Subpart 25.2 of the FAR).

(End of clause)

54 52.225-11 RESTRICTIONS ON CERTAIN FOREIGN PURCHASES (OCT 1996)

(a) Unless advance written approval of the Contracting Officer is obtained, the Contractor shall not acquire, for use in the performance of this contract, any supplies or services originating from sources within, or that were located in or transported from or through, countries whose products are banned from importation into the United States under regulations of the Office of Foreign Assets Control, Department of the Treasury. Those countries include Cuba, Iran, Iraq, Libya, and North Korea.

(b) The Contractor shall not acquire for use in the performance of this contract any supplies or services from entities controlled by the Government of Iraq.

(c) The Contractor agrees to insert the provisions of this clause, including this paragraph (c), in all subcontracts hereunder.

(End of clause)

55 52.225-15 I BUY AMERICAN ACT--CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS ACT AND

NORTH AMERICAN FREE TRADE AGREEMENT (JAN 1996)--ALTERNATE I

(JAN 1996)

(a) Definitions. As used in this clause--

"Components" means those articles, materials, and supplies incorporated directly into construction materials.

"Construction material" means an article, material, or supply brought to the construction site for incorporation into the building or work.

Construction material also includes an item brought to the site pre-assembled from articles, materials, or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, which are discrete systems incorporated into a public building or work and which are produced as a complete system, shall be evaluated as a single and distinct construction material regardless of when or how the individual parts or components of such systems are delivered to the construction site.

"Designated country construction material" means a construction material that (a) is wholly the growth, product, or manufacture of a designated country (as defined at FAR 25.401), or (b) in the case of a construction material which consists in whole or in part of materials from another country or instrumentality, has been substantially transformed in a designated country into a new and different construction material distinct from the materials from which it was transformed.

"Domestic construction material" means (1) an unmanufactured construction material mined or produced in the United States, or (2) a construction material manufactured in the United States, if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind as the construction materials determined to be unavailable pursuant to subparagraph 25.202(a)(3) of the Federal Acquisition Regulation (FAR) shall be treated as domestic.

"North American Free Trade Agreement (NAFTA) country" means Canada or Mexico.

"NAFTA country construction material" means a construction material that (a) is wholly the growth, product, or manufacture of a NAFTA country, or (b) in the case of a construction material which consists in whole or in part of materials from another country or instrumentality, has been substantially transformed in a NAFTA country into a new and different construction material distinct from the materials from which it was transformed.

(b) The Buy American Act (41 U.S.C. 10) provides that the Government give preference to domestic material. In addition, the North American Free Trade Agreement (NAFTA) provides that NAFTA construction materials are exempted from application of the Buy American Act.

(c) The Contractor agrees that only domestic construction materials or NAFTA country construction materials will be used by the Contractor, subcontractors, material men and suppliers in the performance of this

contract, except for other foreign construction materials, if any, listed in this contract.

(End of clause)

56 52.225-15 BUY AMERICAN ACT--CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS ACT  
AND

NORTH AMERICAN FREE TRADE AGREEMENT (JAN 1996)

(a) Definitions. As used in this clause--

"Components" means those articles, materials, and supplies incorporated directly into construction materials.

"Construction material" means an article, material, or supply brought to the construction site for incorporation into the building or work. Construction material also includes an item brought to the site pre-assembled from articles, materials, or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, which are discrete systems incorporated into a public building or work and which are produced as a complete system, shall be evaluated as a single and distinct construction material regardless of when or how the individual parts or components of such systems are delivered to the construction site.

"Designated country construction material" means a construction material that (a) is wholly the growth, product, or manufacture of a designated country (as defined at FAR 25.401), or (b) in the case of a construction material which consists in whole or in part of materials from another country or instrumentality, has been substantially transformed in a designated country into a new and different construction material distinct from the materials from which it was transformed.

"Domestic construction material" means (1) an unmanufactured construction material mined or produced in the United States, or (2) a construction material manufactured in the United States, if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind as the construction materials determined to be unavailable pursuant to subparagraph 25.202(a)(3) of the Federal Acquisition Regulation (FAR) shall be treated as domestic.

"North American Free Trade Agreement (NAFTA) country" means Canada or Mexico.

"NAFTA country construction material" means a construction material that (a) is wholly the growth, product, or manufacture of a NAFTA country, or (b) in the case of a construction material which consists in whole or in

part of materials from another country or instrumentality, has been substantially transformed in a NAFTA country into a new and different construction material distinct from the materials from which it was transformed.

(b) The Buy American Act (41 U.S.C. 10) provides that the Government give preference to domestic material. In addition, the Trade Agreements Act and the North American Free Trade Agreement (NAFTA) provide that designated country and NAFTA construction materials are exempted from application of the Buy American Act.

(c) The Contractor agrees that only domestic construction materials, NAFTA country construction materials or designated country construction materials will be used by the Contractor, subcontractors, material men and suppliers in the performance of this contract, except for other foreign construction materials, if any, listed in this contract.

(End of clause)

57 52.225-7025 FOREIGN SOURCE RESTRICTIONS (SEP 1996)

(a) Definitions.

As used in this clause--

(1) Domestic manufacture means manufactured in the United States or Canada if the Canadian firm--

(i) Normally produces similar items or is currently producing the item in support of DoD contracts (as prime or subcontractor); and

(ii) Agrees to become (upon receiving a contract/order) a planned producer under DoD's Industrial Preparedness Program (IPP), if it is not already a planned producer for the item.

(2) Forging items means--

Items	Categories
Ship propulsion shafts	Excludes service and landing craft shafts
Periscope tubes	All
Ring forgings for bull gears	All greater than 120 inches in diameter

(b) The Contractor agrees that end items and their components delivered under this contract shall contain forging items that are of domestic manufacture only.

(c) The restriction in paragraph (b) of this clause may be waived upon

request from the Contractor in accordance with section 225.7104 of the Defense Federal Acquisition Regulation Supplement.

(d) The Contractor agrees to retain records showing compliance with this restriction until 3 years after final payment and to make records available upon request of the Contracting Officer.

(e) The Contractor agrees to insert this clause, including this paragraph (e), in subcontracts and purchase orders issued in performance of this contract, when products purchased contain restricted forging items.

(End of clause)

58 52.225-7031 SECONDARY ARAB BOYCOTT OF ISRAEL (JUN 1992)

(a) Definitions.

As used in this clause--

(1) "Foreign person" means any person other than a United States person as defined in section 16(2) of the Export Administration Act of 1979 (50 U.S.C. App. Sec 2415).

(2) "United States person" is defined in section 16(2) of the Export Administration Act of 1979 and means any United States resident or national (other than an individual resident outside the United States and employed by other than a United States person), any domestic concern (including any permanent domestic establishment of any foreign concern), and any foreign subsidiary or affiliate (including any permanent foreign establishment) of any domestic concern which is controlled in fact by such domestic concern, as determined under regulations of the President.

(b) Certification.

By submitting this offer, the Offeror, if a foreign person, company or entity, certifies that it--

(1) Does not comply with the Secondary Arab Boycott of Israel; and

(2) Is not taking or knowingly agreeing to take any action, with respect to the Secondary Boycott of Israel by Arab countries, which 50 U.S.C. App. Sec 2407(a) prohibits a United States person from taking.

(End of clause)

59 52.226-1 UTILIZATION OF INDIAN ORGANIZATIONS AND INDIAN-OWNED ECONOMIC ENTERPRISES

(SEP 1996)

(a) For Department of Defense contracts, this clause applies only if the contract includes a subcontracting plan incorporated under the terms of the clause at 52.219-9, Small, Small Disadvantaged and Women-Owned Small

Business Subcontracting Plan. It does not apply to contracts awarded based on a subcontracting plan submitted and approved under paragraph (g) of the clause at 52.219

(b) Definitions. As used in this clause:

"Indian" means any person who is a member of any Indian tribe, band, group, pueblo or community which is recognized by the Federal Government as eligible for services from the Bureau of Indian Affairs (BIA) in accordance with 25 U.S.C. 1452(c) and any "Native" as defined in the Alaska Native Claims Settlement Act (43 U.S.C. 1601).

"Indian organization" means the governing body of any Indian tribe or entity established or recognized by the governing body of an Indian tribe for the purposes of 25 U.S.C., Chapter 17.

"Indian-owned economic enterprise" means any Indian-owned (as determined by the Secretary of the Interior) commercial, industrial, or business activity established or organized for the purpose of profit, provided that Indian ownership shall constitute not less than 51 percent of the enterprise.

"Indian tribe" means any Indian tribe, band, group, pueblo or community, including native villages and native groups (including corporations organized by Kenai, Juneau, Sitka, and Kodiak) as defined in the Alaska Native Claims Settlement Act, which is recognized by the Federal Government as eligible for services from BIA in accordance with 25 U.S.C. 1542(c).

"Interested party" means a prime contractor or an actual or prospective offeror whose direct economic interest would be affected by the award of a subcontract or by the failure to award a subcontract.

(c) The Contractor agrees to use its best efforts to give Indian organizations and Indian-owned economic enterprises (25 U.S.C. 1544) the maximum practicable opportunity to participate in the subcontracts it awards to the fullest extent consistent with efficient performance of its contract.

(1) The Contracting Officer and the Contractor, acting in good faith, may rely on the self-certification of an Indian organization or Indian-owned economic enterprise as to its eligibility, unless an interested party challenges its status or the Contracting Officer has independent reason to question that status. In the event of a challenge to the self-certification of a subcontractor, the Contracting Officer shall refer the matter to the U.S. Department of the Interior, Bureau of Indian Affairs (BIA), Attn: Chief, Division of Contracting and Grants Administration, 1849 C Street, NW, MS-334A-SIB, Washington, DC 20245. The BIA will determine the eligibility and notify the Contracting Officer. The 5 percent incentive payment will not be made within 50 working days of subcontract award or while a challenge is pending. If a subcontractor is determined to be an ineligible participant, no

incentive payment will be made under the Indian Incentive Program.

(2) The Contractor may request an adjustment under the Indian Incentive Program to the following:

(i) The estimated cost of a cost-type contract.

(ii) The target cost of a cost-plus-incentive-fee prime contract.

(iii) The target cost and ceiling price of a fixed-price incentive prime contract.

(iv) The price of a firm-fixed-price prime contract.

(3) The amount of the equitable adjustment to the prime contract shall be 5 percent of the estimated cost, target cost or firm-fixed-price included in the subcontract initially awarded to the Indian organization or Indian-owned economic enterprise.

(4) The Contractor has the burden of proving the amount claimed and must assert its request for an adjustment prior to completion of contract performance.

(d) The Contracting Officer, subject to the terms and conditions of the contract and the availability of funds, shall authorize an incentive payment of 5 percent of the amount paid to the subcontractor. Contracting Officers shall seek funding in accordance with agency procedures. The Contracting Officer's decision is final and not subject to the Disputes clause of this contract.

(End of clause)

60 52.227-1 AUTHORIZATION AND CONSENT (JUL 1995)

(a) The Government authorizes and consents to all use and manufacture, in performing this contract or any subcontract at any tier, of any invention described in and covered by a United States patent (1) embodied in the structure or composition of any article the delivery of which is accepted by the Government under this contract or (2) used in machinery, tools, or methods whose use necessarily results from compliance by the Contractor or a subcontractor with (i) specifications or written provisions forming a part of this contract or (ii) specific written instructions given by the Contracting Officer directing the manner of performance. The entire liability to the Government for infringement of a patent of the United States shall be determined solely by the provisions of the indemnity clause, if any, included in this contract or any subcontract hereunder (including any lower-tier subcontract), and the Government assumes liability for all other infringement to the extent of the authorization and consent hereinabove granted.

(b) The Contractor agrees to include, and require inclusion of, this



clause, suitably modified to identify the parties, in all subcontracts at any tier for supplies or services (including construction, architect-engineer services, and materials, supplies, models, samples, and design or testing services expected to exceed the simplified acquisition threshold); however, omission of this clause from any subcontract, including those at or below the simplified acquisition threshold, does not affect this authorization and consent.

(End of clause)

61 52.227-2 NOTICE AND ASSISTANCE REGARDING PATENT AND COPYRIGHT INFRINGEMENT

(AUG 1996)

(a) The Contractor shall report to the Contracting Officer, promptly and in reasonable written detail, each notice or claim of patent or copyright infringement based on the performance of this contract of which the Contractor has knowledge.

(b) In the event of any claim or suit against the Government on account of any alleged patent or copyright infringement arising out of the performance of this contract or out of the use of any supplies furnished or work or services performed under this contract, the Contractor shall furnish to the Government, when requested by the Contracting Officer, all evidence and information in possession of the Contractor pertaining to such suit or claim. Such evidence and information shall be furnished at the expense of the Government except where the Contractor has agreed to indemnify the Government.

(c) The Contractor agrees to include, and require inclusion of, this clause in all subcontracts at any tier for supplies or services (including construction and architect-engineer subcontracts and those for material, supplies, models, samples, or design or testing services) expected to exceed the simplified acquisition threshold at FAR 2.101.

(End of clause)

62 52.227-4 PATENT INDEMNITY--CONSTRUCTION CONTRACTS (APR 1984)

Except as otherwise provided, the Contractor agrees to indemnify the Government and its officers, agents, and employees against liability, including costs and expenses, for infringement upon any United States patent (except a patent issued upon an application that is now or may hereafter be withheld from issue pursuant to a Secrecy Order under 35 U.S.C. 181) arising out of performing this contract or out of the use or

disposal by or for the account of the Government of supplies furnished or work performed under this contract.

(End of clause)

(R 7-602.16 1964 JUN)

63 52.227-7033 RIGHTS IN SHOP DRAWINGS (APR 1966)

(a) Shop drawings for construction means drawings, submitted to the Government by the Construction Contractor, subcontractor or any lower-tier subcontractor pursuant to a construction contract, showing in detail (i) the proposed fabrication and assembly of structural elements and (ii) the installation (i.e., form, fit, and attachment details) of materials or equipment. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

(b) This clause, including this paragraph (b), shall be included in all subcontracts hereunder at any tier.

(End of clause)

64 52.228-2 ADDITIONAL BOND SECURITY (JUN 1996)

The Contractor shall promptly furnish additional security required to protect the Government and persons supplying labor or materials under this contract if--

(a) Any surety upon any bond, or issuing financial institution for other security, furnished with this contract becomes unacceptable to the Government;

(b) Any surety fails to furnish reports on its financial condition as required by the Government;

(c) The contract price is increased so that the penal sum of any bond becomes inadequate in the opinion of the Contracting Officer; or

(d) The contract performance period is extended and an irrevocable letter of credit (ILC) is used as security. If the Contractor does not furnish an acceptable extension or replacement ILC, or other acceptable substitute, at least 30 days before an ILC's scheduled expiration, the Contracting Officer has the right to immediately draw on the ILC.

(End of clause)

65 52.228-5 INSURANCE--WORK ON A GOVERNMENT INSTALLATION (SEP 1989)

(a) The Contractor shall, at its own expense, provide and maintain

during the entire performance of this contract, at least the kinds and minimum amounts of insurance required in the Schedule or elsewhere in the contract.

(b) Before commencing work under this contract, the Contractor shall certify to the Contracting Officer in writing that the required insurance has been obtained. The policies evidencing required insurance shall contain an endorsement to the effect that any cancellation or any material change adversely affecting the Government's interest shall not be effective

(1) for such period as the laws of the State in which this contract is to be performed prescribe, or (2) until 30 days after the insurer or the Contractor gives written notice to the Contracting Officer, whichever period is longer.

(c) The Contractor shall insert the substance of this clause, including this paragraph (c), in subcontracts under this contract that require work on a Government installation and shall require subcontractors to provide and maintain the insurance required in the Schedule or elsewhere in the contract. The Contractor shall maintain a copy of all subcontractors' proofs of required insurance, and shall make copies available to the Contracting Officer upon request.

(End of clause)

66 52.228-12 PROSPECTIVE SUBCONTRACTOR REQUESTS FOR BONDS (OCT 1995)

In accordance with Section 806(a)(3) of Pub. L. 102-190, as amended by Sections 2091 and 8105 of Pub. L. 103-355, upon the request of a prospective subcontractor or supplier offering to furnish labor or material for the performance of this contract for which a payment bond has been furnished to the Government pursuant to the Miller Act, the Contractor shall promptly provide a copy of such payment bond to the requester.

(End of clause)

67 52.229-3 FEDERAL, STATE, AND LOCAL TAXES (JAN 1991)

(a) "Contract date," as used in this clause, means the date set for bid opening or, if this is a negotiated contract or a modification, the effective date of this contract or modification.

"All applicable Federal, State, and local taxes and duties," as used in this clause, means all taxes and duties, in effect on the contract date, that the taxing authority is imposing and collecting on the transactions or property covered by this contract.

"After-imposed Federal tax," as used in this clause, means any new or

increased Federal excise tax or duty, or tax that was exempted or excluded on the contract date but whose exemption was later revoked or reduced during the contract period, on the transactions or property covered by this contract that the Contractor is required to pay or bear as the result of legislative, judicial, or administrative action taking effect after the contract date. It does not include social security tax or other employment taxes.

"After-relieved Federal tax," as used in this clause, means any amount of Federal excise tax or duty, except social security or other employment taxes, that would otherwise have been payable on the transactions or property covered by this contract, but which the Contractor is not required to pay or bear, or for which the Contractor obtains a refund or drawback, as the result of legislative, judicial, or administrative action taking effect after the contract date.

(b) The contract price includes all applicable Federal, State, and local taxes and duties.

(c) The contract price shall be increased by the amount of any after-imposed Federal tax, provided the Contractor warrants in writing that no amount for such newly imposed Federal excise tax or duty or rate increase was included in the contract price, as a contingency reserve or otherwise.

(d) The contract price shall be decreased by the amount of any after-relieved Federal tax.

(e) The contract price shall be decreased by the amount of any Federal excise tax or duty, except social security or other employment taxes, that the Contractor is required to pay or bear, or does not obtain a refund of, through the Contractor's fault, negligence, or failure to follow instructions of the Contracting Officer.

(f) No adjustment shall be made in the contract price under this clause unless the amount of the adjustment exceeds \$250.

(g) The Contractor shall promptly notify the Contracting Officer of all matters relating to any Federal excise tax or duty that reasonably may be expected to result in either an increase or decrease in the contract price and shall take appropriate action as the Contracting Officer directs.

(h) The Government shall, without liability, furnish evidence appropriate to establish exemption from any Federal, State, or local tax when the Contractor requests such evidence and a reasonable basis exists to sustain the exemption.

(End of clause)

accordance with Part 31 of the Federal Acquisition Regulation (FAR), allowability shall also be determined in accordance with Part 231 of the Defense FAR Supplement, in effect on the date of this contract.

(End of clause)

69 52.232-5 PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS (APR 1989)

(a) The Government shall pay the Contractor the contract price as provided in this contract.

(b) The Government shall make progress payments monthly as the work proceeds, or at more frequent intervals as determined by the Contracting Officer, on estimates of work accomplished which meets the standards of quality established under the contract, as approved by the Contracting Officer. The Contractor shall furnish a breakdown of the total contract price showing the amount included therein for each principal category of the work, which shall substantiate the payment amount requested in order to provide a basis for determining progress payments, in such detail as requested by the Contracting Officer. In the preparation of estimates the Contracting Officer may authorize material delivered on the site and preparatory work done to be taken into consideration. Material delivered to the Contractor at locations other than the site may also be taken into consideration if--

(1) Consideration is specifically authorized by this contract; and

(2) The Contractor furnishes satisfactory evidence that it has acquired title to such material and that the material will be used to perform this contract.

(c) Along with each request for progress payments, the contractor shall furnish the following certification, or payment shall not be made:

I hereby certify, to the best of my knowledge and belief, that--

(1) The amounts requested are only for performance in accordance with the specifications, terms, and conditions of the contract;

(2) Payments to subcontractors and suppliers have been made from previous payments received under the contract, and timely payments will be made from the proceeds of the payment covered by this certification, in accordance with subcontract agreements and the requirements of chapter 39 of Title 31, United States Code; and

(3) This request for progress payments does not include any amounts which the prime contractor intends to withhold or retain from a subcontractor or supplier in accordance with the terms and conditions of the subcontract.

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(Name)

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(Title)

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(Date)

(d) If the Contractor, after making a certified request for progress payments, discovers that a portion or all of such request constitutes a payment for performance by the Contractor that fails to conform to the specifications, terms, and conditions of this contract (hereinafter referred to as the "unearned amount"), the Contractor shall--

(1) Notify the Contracting Officer of such performance deficiency; and

(2) Be obligated to pay the Government an amount (computed by the Contracting Officer in the manner provided in 31 U.S.C 3903(c)(1)) equal to interest on the unearned amount from the date of receipt of the unearned amount until--

(i) The date the Contractor notifies the Contracting Officer that the performance deficiency has been corrected; or

(ii) The date the Contractor reduces the amount of any subsequent certified request for progress payments by an amount equal to the unearned amount.

(e) If the Contracting Officer finds that satisfactory progress was achieved during any period for which a progress payment is to be made, the Contracting Officer shall authorize payment to be made in full. However, if satisfactory progress has not been made, the Contracting Officer may retain a maximum of 10 percent of the amount of the payment until satisfactory progress is achieved. When the work is substantially complete, the Contracting Officer may retain from previously withheld funds and future progress payments that amount the Contracting Officer considers adequate for protection of the Government and shall release to the Contractor all the remaining withheld funds. Also, on completion and acceptance of each separate building, public work, or other division of the contract, for which the price is stated separately in the contract, payment shall be made for the completed work without retention of a percentage.

(f) All material and work covered by progress payments made shall, at the time of payment, become the sole property of the Government, but this shall not be construed as--

(1) Relieving the Contractor from the sole responsibility for all material and work upon which payments have been made or the restoration of any damaged work; or

(2) Waiving the right of the Government to require the fulfillment of all of the terms of the contract.

(g) In making these progress payments, the Government shall, upon request, reimburse the Contractor for the amount of premiums paid for performance and payment bonds (including coinsurance and reinsurance

agreements, when applicable) after the Contractor has furnished evidence of full payment to the surety. The retainage provisions in paragraph (e) of this clause shall not apply to that portion of progress payments attributable to bond premiums.

(h) The Government shall pay the amount due the Contractor under this contract after--

(1) Completion and acceptance of all work;

(2) Presentation of a properly executed voucher; and

(3) Presentation of release of all claims against the Government arising by virtue of this contract, other than claims, in stated amounts, that the Contractor has specifically excepted from the operation of the release. A release may also be required of the assignee if the Contractor's claim to amounts payable under this contract has been assigned under the Assignment of Claims Act of 1940 (31 U.S.C. 3727 and 41 U.S.C. 15).

(i) Notwithstanding any provision of this contract, progress payments shall not exceed 80 percent on work accomplished on undefinitized contract actions. A "contract action" is any action resulting in a contract, as defined in FAR Subpart 2.1, including contract modifications for additional supplies or services, but not including contract modifications that are within the scope and under the terms of the contract, such as contract modifications issued pursuant to the Changes clause, or funding and other administrative changes.

(End of clause)

70 52.232-17 INTEREST (JUN 1996)

(a) Except as otherwise provided in this contract under a Price Reduction for Defective Cost or Pricing Data clause or a Cost Accounting Standards clause, all amounts that become payable by the Contractor to the Government under this contract (net of any applicable tax credit under the Internal Revenue Code (26 U.S.C. 1481)) shall bear simple interest from the date due until paid unless paid within 30 days of becoming due. The interest rate shall be the interest rate established by the Secretary of the Treasury as provided in Section 12 of the Contract Disputes Act of 1978 (Public Law 95-563), which is applicable to the period in which the amount becomes due, as provided in paragraph (b) of this clause, and then at the rate applicable for each six-month period as fixed by the Secretary until the amount is paid.

(b) Amounts shall be due at the earliest of the following dates:

(1) The date fixed under this contract.

(2) The date of the first written demand for payment consistent with

this contract, including any demand resulting from a default termination.

(3) The date the Government transmits to the Contractor a proposed supplemental agreement to confirm completed negotiations establishing the amount of debt.

(4) If this contract provides for revision of prices, the date of written notice to the Contractor stating the amount of refund payable in connection with a pricing proposal or a negotiated pricing agreement not confirmed by contract modification.

(c) The interest charge made under this clause may be reduced under the procedures prescribed in 32.614-2 of the Federal Acquisition Regulation in effect on the date of this contract.

(End of clause)

#### 71 52.232-23 ASSIGNMENT OF CLAIMS (JAN 1986)

(a) The Contractor, under the Assignment of Claims Act, as amended, 31 U.S.C. 3727, 41 U.S.C. 15 (hereafter referred to as "the Act"), may assign its rights to be paid amounts due or to become due as a result of the performance of this contract to a bank, trust company, or other financing institution, including any Federal lending agency. The assignee under such an assignment may thereafter further assign or reassign its right under the original assignment to any type of financing institution described in the preceding sentence.

(b) Any assignment or reassignment authorized under the Act and this clause shall cover all unpaid amounts payable under this contract, and shall not be made to more than one party, except that an assignment or reassignment may be made to one party as agent or trustee for two or more parties participating in the financing of this contract.

(c) The Contractor shall not furnish or disclose to any assignee under this contract any classified document (including this contract) or information related to work under this contract until the Contracting Officer authorizes such action in writing.

(End of clause)

#### 72 52.232-33 MANDATORY INFORMATION FOR ELECTRONIC FUNDS TRANSFER PAYMENT (AUG 1996)

(a) Method of payment. Payments by the Government under this contract, including invoice and contract financing payments, may be made by check or electronic funds transfer (EFT) at the option of the Government. If payment is made by EFT, the Government may, at its option, also forward the associated payment information by electronic transfer. As used in this



clause, the term "EFT" refers to the funds transfer and may also include the information transfer.

(b) Mandatory submission of Contractor's EFT information.

(1) The Contractor is required, as a condition to any payment under this contract, to provide the Government with the information required to make payment by EFT as described in paragraph (d) of this clause, unless the payment office determines that submission of the information is not required. However, until January 1, 1999, in the event the Contractor certifies in writing to the payment office that the Contractor does not have an account with a financial institution or an authorized payment agent, payment shall be made by other than EFT. For any payments to be made after January 1, 1999, the Contractor shall provide EFT information as described in paragraph (d) of this clause.

(2) If the Contractor provides EFT information applicable to multiple contracts, the Contractor shall specifically state the applicability of this EFT information in terms acceptable to the payment office.

(c) Contractor's EFT information. Prior to submission of the first request for payment (whether for invoice or contract financing payment) under this contract, the Contractor shall provide the information required to make contract payment by EFT, as described in paragraph (d) of this clause, directly to the Government payment office named in this contract. If more than one payment office is named for the contract, the Contractor shall provide a separate notice to each office. In the event that the EFT information changes, the Contractor shall be responsible for providing the changed information to the designated payment office(s).

(d) Required EFT information. The Government may make payment by EFT through either an Automated Clearing House (ACH) subject to the banking laws of the United States or the Federal Reserve Wire Transfer System at the Government's option. The Contractor shall provide the following information for both methods in a form acceptable to the designated payment office. The Contractor may supply this data for this or multiple contracts (see paragraph (b) of this clause).

(1) The contract number to which this notice applies.

(2) The Contractor's name and remittance address, as stated in the contract, and account number at the Contractor's financial agent.

(3) The signature (manual or electronic, as appropriate), title, and telephone number of the Contractor official authorized to provide this information.

(4) For ACH payments only:

(i) Name, address, and 9-digit Routing Transit Number of the Contractor's financial agent.

(ii) Contractor's account number and the type of account (checking, saving, or lockbox).

(5) For Federal Reserve Wire Transfer System payments only:

(i) Name, address, telegraphic abbreviation, and the 9-digit Routing Transit Number for the Contractor's financial agent.

(ii) If the Contractor's financial agent is not directly on-line to the Federal Reserve Wire Transfer System and, therefore, not the receiver of the wire transfer payment, the Contractor shall also provide the name, address, and 9-digit Routing Transit Number of the correspondent financial institution receiving the wire transfer payment.

(e) Suspension of payment.

(1) Notwithstanding the provisions of any other clause of this contract, the Government is not required to make any payment under this contract until after receipt, by the designated payment office, of the correct EFT payment information from the Contractor or a certificate submitted in accordance with paragraph (b) of this clause. Until receipt of the correct EFT information, any invoice or contract financing request shall be deemed not to be a valid invoice or contract financing request as defined in the Prompt Payment clause of this contract.

(2) If the EFT information changes after submission of correct EFT information, the Government shall begin using the changed EFT information no later than the 30th day after its receipt to the extent payment is made by EFT. However, the Contractor may request that no further payments be made until the changed EFT information is implemented by the payment office. If such suspension would result in a late payment under the Prompt Payment clause of this contract, the Contractor's request for suspension shall extend the due date for payment by the number of days of the suspension.

(f) Contractor EFT arrangements. The Contractor shall designate a single financial agent capable of receiving and processing the electronic funds transfer using the EFT methods described in paragraph (d) of this clause. The Contractor shall pay all fees and charges for receipt and processing of transfers.

(g) Liability for uncompleted or erroneous transfers.

(1) If an uncompleted or erroneous transfer occurs because the Government failed to use the Contractor-provided EFT information in the correct manner, the Government remains responsible for (i) making a correct payment, (ii) paying any prompt payment penalty due, and (iii) recovering any erroneously directed funds.

(2) If an uncompleted or erroneous transfer occurs because Contractor-provided EFT information was incorrect at the time of Government release of the EFT payment transaction instruction to the Federal Reserve System, and--

(i) If the funds are no longer under the control of the payment

office, the Government is deemed to have made payment and the Contractor is responsible for recovery of any erroneously directed funds; or

(ii) If the funds remain under the control of the payment office, the Government retains the right to either make payment by mail or suspend the payment in accordance with paragraph (e) of this clause.

(h) EFT and prompt payment.

(1) A payment shall be deemed to have been made in a timely manner in accordance with the Prompt Payment clause of this contract if, in the EFT payment transaction instruction given to the Federal Reserve System, the date specified for settlement of the payment is on or before the prompt payment due date, provided the specified payment date is a valid date under the rules of the Federal Reserve System.

(2) When payment cannot be made by EFT because of incorrect EFT information provided by the Contractor, no interest penalty is due after the date of the uncompleted or erroneous payment transaction, provided that notice of the defective EFT information is issued to the Contractor within 7 days after the Government is notified of the defective EFT information.

(i) EFT and assignment of claims. If the Contractor assigns the proceeds of this contract as provided for in the Assignment of Claims clause of this contract, the assignee shall provide the assignee EFT information required by paragraph (d) of this clause. In all respects, the requirements of this clause shall apply to the assignee as if it were the Contractor. EFT information which shows the ultimate recipient of the transfer to be other than the Contractor, in the absence of a proper assignment of claims acceptable to the Government, is incorrect EFT information within the meaning of paragraph (e) of this clause.

(j) Payment office discretion. If the Contractor does not wish to receive payment by EFT methods for one or more payments, the Contractor may submit a request to the designated payment office to refrain from requiring EFT information or using the EFT payment method. The decision to grant the request is solely that of the Government.

(k) Change of EFT information by financial agent. The Contractor agrees that the Contractor's financial agent may notify the Government of a change to the routing transit number, Contractor account number, or account type. The Government shall use the changed data in accordance with paragraph (e)(2) of this clause. The Contractor agrees that the information provided by the agent is deemed to be correct information as if it were provided by the Contractor. The Contractor agrees that the agent's notice of changed EFT data is deemed to be a request by the Contractor in accordance with paragraph (e)(2) that no further payments be made until the changed EFT

information is implemented by the payment office.

(End of clause)

73 52.232-7006 REDUCTION OR SUSPENSION OF CONTRACT PAYMENTS UPON FINDING OF FRAUD  
(AUG

1992)

(a) 10 U.S.C. 2307(e) permits the head of the agency to reduce or suspend further payments to the Contractor upon a written determination by the agency head that substantial evidence exists that the Contractor's request for advance, partial, or progress payments is based on fraud. The provisions of 10 U.S.C. 2307(e) are in addition to any other rights or remedies provided the Government by law or under contract.

(b) Actions taken by the Government in accordance with 10 U.S.C. 2307(e) shall not constitute an excusable delay under the Default clause of this contract or otherwise relieve the Contractor of its obligations to perform under this contract.

(End of clause)

74 52.233-1 DISPUTES (OCT 1995)

(a) This contract is subject to the Contract Disputes Act of 1978, as amended (41 U.S.C. 601-613).

(b) Except as provided in the Act, all disputes arising under or relating to this contract shall be resolved under this clause.

(c) "Claim," as used in this clause, means a written demand or written assertion by one of the contracting parties seeking, as a matter of right, the payment of money in a sum certain, the adjustment or interpretation of contract terms, or other relief arising under or relating to this contract. A claim arising under a contract, unlike a claim relating to that contract, is a claim that can be resolved under a contract clause that provides for the relief sought by the claimant. However, a written demand or written assertion by the Contractor seeking the payment of money exceeding \$100,000 is not a claim under the Act until certified as required by subparagraph (d)(2) of this clause. A voucher, invoice, or other routine request for payment that is not in dispute when submitted is not a claim under the Act. The submission may be converted to a claim under the Act, by complying with the submission and certification requirements of this clause, if it is disputed either as to liability or amount or is not acted upon in a reasonable time.

(d)(1) A claim by the Contractor shall be made in writing and, unless otherwise stated in this contract, submitted within 6 years after accrual of the claim to the Contracting Officer for a written decision. A claim by the Government against the Contractor shall be subject to a written decision by the Contracting Officer.

(2)(i) Contractors shall provide the certification specified in subparagraph (d)(2)(iii) of this clause when submitting any claim--

(A) Exceeding \$100,000; or

(B) Regardless of the amount claimed, when using--

(1) Arbitration conducted pursuant to 5 U.S.C. 575-580; or

(2) Any other alternative means of dispute resolution (ADR) technique that the agency elects to handle in accordance with the Administrative Dispute Resolution Act (ADRA).

(ii) The certification requirement does not apply to issues in controversy that have not been submitted as all or part of a claim.

(iii) The certification shall state as follows:

"I certify that the claim is made in good faith; that the supporting data are accurate and complete to the best of my knowledge and belief; that the amount requested accurately reflects the contract adjustment for which the Contractor believes the Government is liable; and that I am duly authorized to certify the claim on behalf of the Contractor."

(3) The certification may be executed by any person duly authorized to bind the Contractor with respect to the claim.

(e) For Contractor claims of \$100,000 or less, the Contracting Officer must, if requested in writing by the Contractor, render a decision within 60 days of the request. For Contractor-certified claims over \$100,000, the Contracting Officer must, within 60 days, decide the claim or notify the Contractor of the date by which the decision will be made.

(f) The Contracting Officer's decision shall be final unless the Contractor appeals or files a suit as provided in the Act.

(g) If the claim by the Contractor is submitted to the Contracting Officer or a claim by the Government is presented to the Contractor, the parties, by mutual consent, may agree to use ADR. If the Contractor refuses an offer for alternative disputes resolution, the Contractor shall inform the Contracting Officer, in writing, of the Contractor's specific reasons for rejecting the request. When using arbitration conducted pursuant to 5 U.S.C. 575-580, or when using any other ADR technique that the agency elects to handle in accordance with the ADRA, any claim, regardless of amount, shall be accompanied by the certification described in subparagraph (d)(2)(iii) of this clause, and executed in accordance with subparagraph (d)(3) of this clause.

(h) The Government shall pay interest on the amount found due and unpaid from (1) the date that the Contracting Officer receives the claim

(certified, if required); or (2) the date that payment otherwise would be due, if that date is later, until the date of payment. With regard to claims having defective certifications, as defined in (FAR) 48 CFR 33.201, interest shall be paid from the date that the Contracting Officer initially receives the claim. Simple interest on claims shall be paid at the rate, fixed by the Secretary of the Treasury as provided in the Act, which is applicable to the period during which the Contracting Officer receives the claim and then at the rate applicable for each 6-month period as fixed by the Treasury Secretary during the pendency of the claim.

(i) The Contractor shall proceed diligently with performance of this contract, pending final resolution of any request for relief, claim, appeal, or action arising under the contract, and comply with any decision of the Contracting Officer.

(End of clause)

75 52.233-3 PROTEST AFTER AWARD (AUG 1996)

(a) Upon receipt of a notice of protest (as defined in FAR 33.101) or a determination that a protest is likely (see FAR 33.102(d)), the Contracting Officer may, by written order to the Contractor, direct the Contractor to stop performance of the work called for by this contract. The order shall be specifically identified as a stop-work order issued under this clause. Upon receipt of the order, the Contractor shall immediately comply with its terms and take all reasonable steps to minimize the incurrence of costs allocable to the work covered by the order during the period of work stoppage. Upon receipt of the final decision in the protest, the Contracting Officer shall either--

(1) Cancel the stop-work order; or

(2) Terminate the work covered by the order as provided in the Default, or the Termination for Convenience of the Government, clause of this contract.

(b) If a stop-work order issued under this clause is canceled either before or after a final decision in the protest, the Contractor shall resume work. The Contracting Officer shall make an equitable adjustment in the delivery schedule or contract price, or both, and the contract shall be modified, in writing, accordingly, if--

(1) The stop-work order results in an increase in the time required for, or in the Contractor's cost properly allocable to, the performance of any part of this contract; and

(2) The Contractor asserts its right to an adjustment within 30 days after the end of the period of work stoppage; provided, that if the Contracting Officer decides the facts justify the action, the Contracting

Officer may receive and act upon a proposal at any time before final payment under this contract.

(c) If a stop-work order is not canceled and the work covered by the order is terminated for the convenience of the Government, the Contracting Officer shall allow reasonable costs resulting from the stop-work order in arriving at the termination settlement.

(d) If a stop-work order is not canceled and the work covered by the order is terminated for default, the Contracting Officer shall allow, by equitable adjustment or otherwise, reasonable costs resulting from the stop-work order.

(e) The Government's rights to terminate this contract at any time are not affected by action taken under this clause.

(f) If, as the result of the Contractor's intentional or negligent misstatement, misrepresentation, or miscertification, a protest related to this contract is sustained, and the Government pays costs, as provided in FAR 33.102(b)(2) or 33.104(h)(1), the Government may require the Contractor to reimburse the Government the amount of such costs. In addition to any other remedy available, and pursuant to the requirements of Subpart 32.6, the Government may collect this debt by offsetting the amount against any payment due the Contractor under any contract between the Contractor and the Government.

(End of clause)

76 52.233-7000 CERTIFICATION OF CLAIMS AND REQUESTS FOR ADJUSTMENT OR RELIEF (MAY 1994)

(a) Any contract claim, request for equitable adjustment to contract terms, request for relief under Pub. L. 85-804, or other similar request exceeding \$100,000 shall bear, at the time of submission, the following certificate given by an individual who has knowledge of the basis of the claim or request, knowledge of the accuracy and completeness of the supporting data, and knowledge of the claim or request:

I certify that the claim is made in good faith, that the supporting data are accurate and complete to the best of my knowledge and belief; that the amount requested accurately reflects the contract adjustment for which the Contractor believes the Government is liable; and that I am duly authorized to certify the claim on behalf of the Contractor.

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(Official's Name)

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(Title)

(b) The certification in paragraph (a) of this clause requires full

disclosure of all relevant facts, including cost and pricing data.

(c) The certification requirement in paragraph (a) of this clause does not apply to:

- (1) Requests for routine contract payments; for example, those for payment for accepted supplies and services, routine vouchers under cost-reimbursement type contracts, and progress payment invoices; or
- (2) Final adjustments under incentive provisions of contracts.

(d) In those situations where no claim certification for the purposes of 10 U.S.C. 2410e has been submitted prior to the inception of a contract dispute, a single certification, using the language prescribed by the Contract Disputes Act (41 U.S.C. 601 et seq.) but signed by an individual who is authorized to bind the contractor and who has knowledge of the basis of the claim or request, knowledge of the accuracy and completeness of the supporting data, and knowledge of the claim or request, will satisfy the certification requirements of both statutes.

(e) If this is a request for equitable adjustment under a substantially completed contract or a completed contract, the certification will be expanded to include the following:

This claim includes only costs for performing the alleged change, and does not include any costs which have already been reimbursed or which have been separately claimed. All indirect costs claimed are properly allocable to the alleged change in accordance with applicable acquisition regulations. I am aware that the submission of a false claim to the Government can result in the assessment of significant criminal and civil penalties and fines.

(End of clause)

77 52.236-2 DIFFERING SITE CONDITIONS (APR 1984)

(a) The Contractor shall promptly, and before the conditions are disturbed, give a written notice to the Contracting Officer of (1) subsurface or latent physical conditions at the site which differ materially from those indicated in this contract, or (2) unknown physical conditions at the site, of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in the contract.

(b) The Contracting Officer shall investigate the site conditions promptly after receiving the notice. If the conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performing any part of the work under this contract, whether or not changed as a result of the conditions,



an equitable adjustment shall be made under this clause and the contract modified in writing accordingly.

(c) No request by the Contractor for an equitable adjustment to the contract under this clause shall be allowed, unless the Contractor has given the written notice required; provided, that the time prescribed in (a) above for giving written notice may be extended by the Contracting Officer.

(d) No request by the Contractor for an equitable adjustment to the contract for differing site conditions shall be allowed if made after final payment under this contract.

(End of clause)

78 52.236-3 SITE INVESTIGATION AND CONDITIONS AFFECTING THE WORK (APR 1984)

(a) The Contractor acknowledges that it has taken steps reasonably necessary to ascertain the nature and location of the work, and that it has investigated and satisfied itself as to the general and local conditions which can affect the work or its cost, including but not limited to (1) conditions bearing upon transportation, disposal, handling, and storage of materials; (2) the availability of labor, water, electric power, and roads; (3) uncertainties of weather, river stages, tides, or similar physical conditions at the site; (4) the conformation and conditions of the ground; and (5) the character of equipment and facilities needed preliminary to and during work performance. The Contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory work done by the Government, as well as from the drawings and specifications made a part of this contract. Any failure of the Contractor to take the actions described and acknowledged in this paragraph will not relieve the Contractor from responsibility for estimating properly the difficulty and cost of successfully performing the work, or for proceeding to successfully perform the work without additional expense to the Government.

(b) The Government assumes no responsibility for any conclusions or interpretations made by the Contractor based on the information made available by the Government. Nor does the Government assume responsibility for any understanding reached or representation made concerning conditions which can affect the work by any of its officers or agents before the execution of this contract, unless that understanding or representation is expressly stated in this contract.

(End of clause)

79 52.236-5 MATERIAL AND WORKMANSHIP (APR 1984)

(a) All equipment, material, and articles incorporated into the work covered by this contract shall be new and of the most suitable grade for the purpose intended, unless otherwise specifically provided in this contract. References in the specifications to equipment, material, articles, or patented processes by trade name, make, or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition. The Contractor may, at its option, use any equipment, material, article, or process that, in the judgment of the Contracting Officer, is equal to that named in the specifications, unless otherwise specifically provided in this contract.

(b) The Contractor shall obtain the Contracting Officer's approval of the machinery and mechanical and other equipment to be incorporated into the work. When requesting approval, the Contractor shall furnish to the Contracting Officer the name of the manufacturer, the model number, and other information concerning the performance, capacity, nature, and rating of the machinery and mechanical and other equipment. When required by this contract or by the Contracting Officer, the Contractor shall also obtain the Contracting Officer's approval of the material or articles which the Contractor contemplates incorporating into the work. When requesting approval, the Contractor shall provide full information concerning the material or articles. When directed to do so, the Contractor shall submit samples for approval at the Contractor's expense, with all shipping charges prepaid. Machinery, equipment, material, and articles that do not have the required approval shall be installed or used at the risk of subsequent rejection.

(c) All work under this contract shall be performed in a skillful and workmanlike manner. The Contracting Officer may require, in writing, that the Contractor remove from the work any employee the Contracting Officer deems incompetent, careless, or otherwise objectionable.

(End of clause)

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80 52.236-6 SUPERINTENDENCE BY THE CONTRACTOR (APR 1984)

At all times during performance of this contract and until the work is completed and accepted, the Contractor shall directly superintend the work or assign and have on the work site a competent superintendent who is

satisfactory to the Contracting Officer and has authority to act for the Contractor.

(End of clause)

81 52.236-7 PERMITS AND RESPONSIBILITIES (NOV 1991)

The Contractor shall, without additional expense to the Government, be responsible for obtaining any necessary licenses and permits, and for complying with any Federal, State, and municipal laws, codes, and regulations applicable to the performance of the work. The Contractor shall also be responsible for all damages to persons or property that occur as a result of the Contractor's fault or negligence. The Contractor shall also be responsible for all materials delivered and work performed until completion and acceptance of the entire work, except for any completed unit of work which may have been accepted under the contract.

(End of clause)

82 52.236-8 OTHER CONTRACTS (APR 1984)

The Government may undertake or award other contracts for additional work at or near the site of the work under this contract. The Contractor shall fully cooperate with the other contractors and with Government employees and shall carefully adapt scheduling and performing the work under this contract to accommodate the additional work, heeding any direction that may be provided by the Contracting Officer. The Contractor shall not commit or permit any act that will interfere with the performance of work by any other contractor or by Government employees.

(End of clause)

83 52.236-9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND

IMPROVEMENTS (APR 1984)

(a) The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the

careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.

(b) The Contractor shall protect from damage all existing improvements and utilities (1) at or near the work site, and (2) on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

(End of clause)

84 52.236-10 OPERATIONS AND STORAGE AREAS (APR 1984)

(a) The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

(b) Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.

(c) The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

(End of clause)

85 52.236-11 USE AND POSSESSION PRIOR TO COMPLETION (APR 1984)

(a) The Government shall have the right to take possession of or use any completed or partially completed part of the work. Before taking possession of or using any work, the Contracting Officer shall furnish the Contractor a list of items of work remaining to be performed or corrected on those portions of the work that the Government intends to take possession of or use. However, failure of the Contracting Officer to list any item of work shall not relieve the Contractor of responsibility for complying with the terms of the contract. The Government's possession or use shall not be deemed an acceptance of any work under the contract.

(b) While the Government has such possession or use, the Contractor shall be relieved of the responsibility for the loss of or damage to the work resulting from the Government's possession or use, notwithstanding the terms of the clause in this contract entitled "Permits and Responsibilities." If prior possession or use by the Government delays the progress of the work or causes additional expense to the Contractor, an equitable adjustment shall be made in the contract price or the time of completion, and the contract shall be modified in writing accordingly.

(End of clause)

86 52.236-12 CLEANING UP (APR 1984)

The Contractor shall at all times keep the work area, including storage areas, free from accumulations of waste materials. Before completing the work, the Contractor shall remove from the work and premises any rubbish, tools, scaffolding, equipment, and materials that are not the property of the Government. Upon completing the work, the Contractor shall leave the work area in a clean, neat, and orderly condition satisfactory to the Contracting Officer.

(End of clause)

87 52.236-13 I ACCIDENT PREVENTION (NOV 1991)--ALTERNATE I (NOV 1991)

(a) The Contractor shall provide and maintain work environments and procedures which will (1) safeguard the public and Government personnel, property, materials, supplies, and equipment exposed to Contractor operations and activities; (2) avoid interruptions of Government operations and delays in project completion dates; and (3) control costs

in the performance of this contract.

(b) For these purposes on contracts for construction or dismantling, demolition, or removal of improvements, the Contractor shall--

(1) Provide appropriate safety barricades, signs, and signal lights;

(2) Comply with the standards issued by the Secretary of Labor at 29 CFR Part 1926 and 29 CFR Part 1910; and

(3) Ensure that any additional measures the Contracting Officer determines to be reasonably necessary for the purposes are taken.

(c) If this contract is for construction or dismantling, demolition or removal of improvements with any Department of Defense agency or component, the Contractor shall comply with all pertinent provisions of the latest version of U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, in effect on the date of the solicitation.

(d) Whenever the Contracting Officer becomes aware of any noncompliance with these requirements or any condition which poses a serious or imminent danger to the health or safety of the public or Government personnel, the Contracting Officer shall notify the Contractor orally, with written confirmation, and request immediate initiation of corrective action. This notice, when delivered to the Contractor or the Contractor's representative at the work site, shall be deemed sufficient notice of the noncompliance and that corrective action is required. After receiving the notice, the Contractor shall immediately take corrective action. If the Contractor fails or refuses to promptly take corrective action, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. The Contractor shall not be entitled to any equitable adjustment of the contract price or extension of the performance schedule on any stop work order issued under this clause.

(e) The Contractor shall insert this clause, including this paragraph (e), with appropriate changes in the designation of the parties, in subcontracts.

(f) Before commencing the work, the Contractor shall--

(1) Submit a written proposed plan for implementing this clause. The plan shall include an analysis of the significant hazards to life, limb, and property inherent in contract work performance and a plan for controlling these hazards; and

(2) Meet with representatives of the Contracting Officer to discuss and develop a mutual understanding relative to administration of the overall safety program.

(End of clause)

(a) The Contractor shall, within five days after the work commences on the contract or another period of time determined by the Contracting Officer, prepare and submit to the Contracting Officer for approval three copies of a practicable schedule showing the order in which the Contractor proposes to perform the work, and the dates on which the Contractor contemplates starting and completing the several salient features of the work (including acquiring materials, plant, and equipment). The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the period. If the Contractor fails to submit a schedule within the time prescribed, the Contracting Officer may withhold approval of progress payments until the Contractor submits the required schedule.

(b) The Contractor shall enter the actual progress on the chart as directed by the Contracting Officer, and upon doing so shall immediately deliver three copies of the annotated schedule to the Contracting Officer. If, in the opinion of the Contracting Officer, the Contractor falls behind the approved schedule, the Contractor shall take steps necessary to improve its progress, including those that may be required by the Contracting Officer, without additional cost to the Government. In this circumstance, the Contracting Officer may require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction plant, and to submit for approval any supplementary schedule or schedules in chart form as the Contracting Officer deems necessary to demonstrate how the approved rate of progress will be regained.

(c) Failure of the Contractor to comply with the requirements of the Contracting Officer under this clause shall be grounds for a determination by the Contracting Officer that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within the time specified in the contract. Upon making this determination, the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part of it, in accordance with the default terms of this contract.

(End of clause)

89 52.236-21 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (APR 1984)

(a) The Contractor shall keep on the work site a copy of the drawings and specifications and shall at all times give the Contracting Officer access thereto. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawings and specifications, the

specifications shall govern. In case of discrepancy in the figures, in the drawings, or in the specifications, the matter shall be promptly submitted to the Contracting Officer, who shall promptly make a determination in writing. Any adjustment by the Contractor without such a determination shall be at its own risk and expense. The Contracting Officer shall furnish from time to time such detailed drawings and other information as considered necessary, unless otherwise provided.

(b) Wherever in the specifications or upon the drawings the words "directed", "required", "ordered", "designated", "prescribed", or words of like import are used, it shall be understood that the "direction", "requirement", "order", "designation", or "prescription", of the Contracting Officer is intended and similarly the words "approved", "acceptable", "satisfactory", or words of like import shall mean "approved by", or "acceptable to", or "satisfactory to" the Contracting Officer, unless otherwise expressly stated.

(c) Where "as shown", "as indicated", "as detailed", or words of similar import are used, it shall be understood that the reference is made to the drawings accompanying this contract unless stated otherwise. The word "provided" as used herein shall be understood to mean "provide complete in place," that is "furnished and installed".

(d) Shop drawings means drawings, submitted to the Government by the Contractor, subcontractor, or any lower tier subcontractor pursuant to a construction contract, showing in detail (1) the proposed fabrication and assembly of structural elements, and (2) the installation (i.e., fit, and attachment details) of materials or equipment. It includes drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials furnished by the contractor to explain in detail specific portions of the work required by the contract. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

(e) If this contract requires shop drawings, the Contractor shall coordinate all such drawings, and review them for accuracy, completeness, and compliance with contract requirements and shall indicate its approval thereon as evidence of such coordination and review. Shop drawings submitted to the Contracting Officer without evidence of the Contractor's approval may be returned for resubmission. The Contracting Officer will indicate an approval or disapproval of the shop drawings and if not approved as submitted shall indicate the Government's reasons therefor. Any work done before such approval shall be at the Contractor's risk. Approval by the Contracting Officer shall not relieve the Contractor from responsibility for any errors or omissions in such drawings, nor from responsibility for complying with the requirements of this contract, except with respect to variations described and approved in accordance with (f)



below.

(f) If shop drawings show variations from the contract requirements, the Contractor shall describe such variations in writing, separate from the drawings, at the time of submission. If the Contracting Officer approves any such variation, the Contracting Officer shall issue an appropriate contract modification, except that, if the variation is minor or does not involve a change in price or in time of performance, a modification need not be issued.

(g) The Contractor shall submit to the Contracting Officer for approval four copies (unless otherwise indicated) of all shop drawings as called for under the various headings of these specifications. Three sets (unless otherwise indicated) of all shop drawings, will be retained by the Contracting Officer and one set will be returned to the Contractor.

(h) This clause shall be included in all subcontracts at any tier.

(End of clause)

90 52.236-26 PRECONSTRUCTION CONFERENCE (FEB 1995)

If the Contracting Officer decides to conduct a preconstruction conference, the successful offeror will be notified and will be required to attend. The Contracting Officer's notification will include specific details regarding the date, time, and location of the conference, any need for attendance by subcontractors, and information regarding the items to be discussed.

(End of clause)

91 52.236-7000 MODIFICATION PROPOSALS--PRICE BREAKDOWN (DEC 1991)

(a) The Contractor shall furnish a price breakdown, itemized as required and within the time specified by the Contracting Officer, with any proposal for a contract modification.

(b) The price breakdown--

(1) Must include sufficient detail to permit an analysis of profit, and of all costs for--

(i) Material;

(ii) Labor;

(iii) Equipment;

(iv) Subcontracts; and

(v) Overhead; and

(2) Must cover all work involved in the modification, whether the work was deleted, added, or changed.

(c) The Contractor shall provide similar price breakdowns to support any amounts claimed for subcontracts.

(d) The Contractor's proposal shall include a justification for any time extension proposed.

(End of clause)

92 52.236-7008 CONTRACT PRICES--BIDDING SCHEDULES (DEC 1991)

(a) The Government's payment for the items listed in the Bidding Schedule shall constitute full compensation to the Contractor for--

(1) Furnishing all plant, labor, equipment, appliances, and materials;  
and

(2) Performing all operations required to complete the work in conformity with the drawings and specifications.

(b) The Contractor shall include in the prices for the items listed in the Bidding Schedule all costs for work in the specifications, whether or not specifically listed in the Bidding Schedule.

(End of provision)

93 52.242-13 BANKRUPTCY (JUL 1995)

In the event the Contractor enters into proceedings relating to bankruptcy, whether voluntary or involuntary, the Contractor agrees to furnish, by certified mail or electronic commerce method authorized by the contract, written notification of the bankruptcy to the Contracting Officer responsible for administering the contract. This notification shall be furnished within five days of the initiation of the proceedings relating to bankruptcy filing. This notification shall include the date on which the bankruptcy petition was filed, the identity of the court in which the bankruptcy petition was filed, and a listing of Government contract numbers and contracting offices for all Government contracts against which final payment has not been made. This obligation remains in effect until final payment under this contract.

(End of clause)

94 52.242-14 SUSPENSION OF WORK (APR 1984)

(a) The Contracting Officer may order the Contractor, in writing, to suspend, delay, or interrupt all or any part of the work of this contract for the period of time that the Contracting Officer determines appropriate

for the convenience of the Government.

(b) If the performance of all or any part of the work is, for an unreasonable period of time, suspended, delayed, or interrupted (1) by an act of the Contracting Officer in the administration of this contract, or (2) by the Contracting Officer's failure to act within the time specified in this contract (or within a reasonable time if not specified), an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) necessarily caused by the unreasonable suspension, delay, or interruption, and the contract modified in writing accordingly. However, no adjustment shall be made under this clause for any suspension, delay, or interruption to the extent that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor, or for which an equitable adjustment is provided for or excluded under any other term or condition of this contract.

(c) A claim under this clause shall not be allowed (1) for any costs incurred more than 20 days before the Contractor shall have notified the Contracting Officer in writing of the act or failure to act involved (but this requirement shall not apply as to a claim resulting from a suspension order), and (2) unless the claim, in an amount stated, is asserted in writing as soon as practicable after the termination of the suspension, delay, or interruption, but not later than the date of final payment under the contract.

(End of clause)

95 52.242-7000 POSTAWARD CONFERENCE (DEC 1991)

The Contractor agrees to attend any postaward conference convened by the contracting activity or contract administration office in accordance with Federal Acquisition Regulation Subpart 42.5.

(End of clause)

96 52.243-4 CHANGES (AUG 1987)

(a) The Contracting Officer may, at any time, without notice to the sureties, if any, by written order designated or indicated to be a change order, make changes in the work within the general scope of the contract, including changes--

- (1) In the specifications (including drawings and designs);
- (2) In the method or manner of performance of the work;
- (3) In the Government-furnished facilities, equipment, materials,

services, or site; or

(4) Directing acceleration in the performance of the work.

(b) Any other written or oral order (which, as used in this paragraph (b), includes direction, instruction, interpretation, or determination) from the Contracting Officer that causes a change shall be treated as a change order under this clause; provided, that the Contractor gives the Contracting Officer written notice stating (1) the date, circumstances, and source of the order and (2) that the Contractor regards the order as a change order.

(c) Except as provided in this clause, no order, statement, or conduct of the Contracting Officer shall be treated as a change under this clause or entitle the Contractor to an equitable adjustment.

(d) If any change under this clause causes an increase or decrease in the Contractor's cost of, or the time required for, the performance of any part of the work under this contract, whether or not changed by any such order, the Contracting Officer shall make an equitable adjustment and modify the contract in writing. However, except for an adjustment based on defective specifications, no adjustment for any change under paragraph (b) of this clause shall be made for any costs incurred more than 20 days before the Contractor gives written notice as required. In the case of defective specifications for which the Government is responsible, the equitable adjustment shall include any increased cost reasonably incurred by the Contractor in attempting to comply with the defective specifications.

(e) The Contractor must assert its right to an adjustment under this clause within 30 days after (1) receipt of a written change order under paragraph (a) of this clause or (2) the furnishing of a written notice under paragraph (b) of this clause, by submitting to the Contracting Officer a written statement describing the general nature and amount of the proposal, unless this period is extended by the Government. The statement of proposal for adjustment may be included in the notice under paragraph (b) above.

(f) No proposal by the Contractor for an equitable adjustment shall be allowed if asserted after final payment under this contract.

(End of clause)

#### 97 52.243-7001 PRICING OF CONTRACT MODIFICATIONS (DEC 1991)

When costs are a factor in any price adjustment under this contract, the contract cost principles and procedures in FAR Part 31 and DFARS Part 231, in effect on the date of this contract, apply.

(End of clause)

(a) This clause does not apply to firm-fixed-price contracts and fixed-price contracts with economic price adjustment. However, it does apply to subcontracts resulting from unpriced modifications to such contracts.

(b) "Subcontract," as used in this clause, includes but is not limited to purchase orders, and changes and modifications to purchase orders. The Contractor shall notify the Contracting Officer reasonably in advance of entering into any subcontract if the Contractor does not have an approved purchasing system and if the subcontract--

(1) Is proposed to exceed \$100,000; or

(2) Is one of a number of subcontracts with a single subcontractor, under this contract, for the same or related supplies or services, that in the aggregate are expected to exceed \$100,000.

(c) The advance notification required by paragraph (b) above shall include--

(1) A description of the supplies or services to be subcontracted;

(2) Identification of the type of subcontract to be used;

(3) Identification of the proposed subcontractor and an explanation of why and how the proposed subcontractor was selected, including the competition obtained;

(4) The proposed subcontract price and the Contractor's cost or price analysis;

(5) The subcontractor's current, complete, and accurate cost or pricing data and Certificate of Current Cost or Pricing Data, if required by other contract provisions;

(6) The subcontractor's Disclosure Statement or Certificate relating to Cost Accounting Standards when such data are required by other provisions of this contract; and

(7) A negotiation memorandum reflecting--

(i) The principal elements of the subcontract price negotiations;

(ii) The most significant considerations controlling establishment of initial or revised prices;

(iii) The reason cost or pricing data were or were not required;

(iv) The extent, if any, to which the Contractor did not rely on the subcontractor's cost or pricing data in determining the price objective and in negotiating the final price;

(v) The extent, if any, to which it was recognized in the negotiation that the subcontractor's cost or pricing data were not accurate, complete, or current; the action taken by the Contractor and subcontractor; and the effect of any such defective data on the total price negotiated;

- (vi) The reasons for any significant difference between the Contractor's price objective and the price negotiated; and
  - (vii) A complete explanation of the incentive fee or profit plan when incentives are used. The explanation shall identify each critical performance element, management decisions used to quantify each incentive element, reasons for the incentives, and a summary of all trade-off possibilities considered.
- (d) The Contractor shall obtain the Contracting Officer's written consent before placing any subcontract for which advance notification is required under paragraph (b) above. However, the Contracting Officer may ratify in writing any such subcontract. Ratification shall constitute the consent of the Contracting Officer.
- (e) Even if the Contractor's purchasing system has been approved, the Contractor shall obtain the Contracting Officer's written consent before placing subcontracts identified below: \_\_\_\_\_
- (f) Unless the consent or approval specifically provides otherwise, neither consent by the Contracting Officer to any subcontract nor approval of the Contractor's purchasing system shall constitute a determination (1) of the acceptability of any subcontract terms or conditions, (2) of the acceptability of any subcontract price or of any amount paid under any subcontract, or (3) to relieve the Contractor of any responsibility for performing this contract.
- (g) No subcontract placed under this contract shall provide for payment on a cost-plus-a-percentage-of-cost basis, and any fee payable under cost-reimbursement subcontracts shall not exceed the fee limitations in subsection 15.903(d) of the Federal Acquisition Regulation (FAR).
- (h) The Government reserves the right to review the Contractor's purchasing system as set forth in FAR Subpart 44.3.
- (End of clause)

99 52.246-12 INSPECTION OF CONSTRUCTION (AUG 1996)

- (a) Definition. "Work" includes, but is not limited to, materials, workmanship, and manufacture and fabrication of components.
- (b) The Contractor shall maintain an adequate inspection system and perform such inspections as will ensure that the work performed under the contract conforms to contract requirements. The Contractor shall maintain complete inspection records and make them available to the Government. All work shall be conducted under the general direction of the Contracting Officer and is subject to Government inspection and test at all places and at all reasonable times before acceptance to ensure strict compliance with the terms of the contract.

(c) Government inspections and tests are for the sole benefit of the Government and do not--

(1) Relieve the Contractor of responsibility for providing adequate quality control measures;

(2) Relieve the Contractor of responsibility for damage to or loss of the material before acceptance;

(3) Constitute or imply acceptance; or

(4) Affect the continuing rights of the Government after acceptance of the completed work under paragraph (i) below.

(d) The presence or absence of a Government inspector does not relieve the Contractor from any contract requirement, nor is the inspector authorized to change any term or condition of the specification without the Contracting Officer's written authorization.

(e) The Contractor shall promptly furnish, at no increase in contract price, all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by the Contracting Officer. The Government may charge to the Contractor any additional cost of inspection or test when work is not ready at the time specified by the Contractor for inspection or test, or when prior rejection makes reinspection or retest necessary. The Government shall perform all inspections and tests in a manner that will not unnecessarily delay the work. Special, full size, and performance tests shall be performed as described in the contract.

(f) The Contractor shall, without charge, replace or correct work found by the Government not to conform to contract requirements, unless in the public interest the Government consents to accept the work with an appropriate adjustment in contract price. The Contractor shall promptly segregate and remove rejected material from the premises.

(g) If the Contractor does not promptly replace or correct rejected work, the Government may (1) by contract or otherwise, replace or correct the work and charge the cost to the Contractor or (2) terminate for default the Contractor's right to proceed.

(h) If, before acceptance of the entire work, the Government decides to examine already completed work by removing it or tearing it out, the Contractor, on request, shall promptly furnish all necessary facilities, labor, and material. If the work is found to be defective or nonconforming in any material respect due to the fault of the Contractor or its subcontractors, the Contractor shall defray the expenses of the examination and of satisfactory reconstruction. However, if the work is found to meet contract requirements, the Contracting Officer shall make an equitable adjustment for the additional services involved in the examination and reconstruction, including, if completion of the work was thereby delayed, an extension of time.

(i) Unless otherwise specified in the contract, the Government shall accept, as promptly as practicable after completion and inspection, all work required by the contract or that portion of the work the Contracting Officer determines can be accepted separately. Acceptance shall be final and conclusive except for latent defects, fraud, gross mistakes amounting to fraud, or the Government's rights under any warranty or guarantee.

(End of clause)

100 52.247-63 PREFERENCE FOR U.S.-FLAG AIR CARRIERS (APR 1984)

(a) "International air transportation," as used in this clause, means transportation by air between a place in the United States and a place outside the United States or between two places both of which are outside the United States.

"United States," as used in this clause, means the 50 States, the District of Columbia, the Commonwealth of Puerto Rico, and possessions of the United States.

"U.S.-flag air carrier," as used in this clause, means an air carrier holding a certificate under section 401 of the Federal Aviation Act of 1958 (49 U.S.C. 1371).

(b) Section 5 of the International Air Transportation Fair Competitive Practices Act of 1974 (49 U.S.C. 1517) (Fly America Act) requires that all Federal agencies and Government contractors and subcontractors use U.S.-flag air carriers for U.S. Government-financed international air transportation of personnel (and their personal effects) or property, to the extent that service by those carriers is available. It requires the Comptroller General of the United States, in the absence of satisfactory proof of the necessity for foreign-flag air transportation, to disallow expenditures from funds, appropriated or otherwise established for the account of the United States, for international air transportation secured aboard a foreign-flag air carrier if a U.S.-flag air carrier is available to provide such services.

(c) The Contractor agrees, in performing work under this contract, to use U.S.-flag air carriers for international air transportation of personnel (and their personal effects) or property to the extent that service by those carriers is available.

(d) In the event that the Contractor selects a carrier other than a U.S.-flag air carrier for international air transportation, the Contractor shall include a certification on vouchers involving such transportation essentially as follows:

CERTIFICATION OF UNAVAILABILITY OF U.S.-  
FLAG AIR CARRIERS



I hereby certify that international air transportation of persons (and their personal effects) or property by U.S.-flag air carrier was not available or it was necessary to use foreign-flag air carrier service for the following reasons (see section 47.403 of the Federal Acquisition Regulation): [State reasons]:

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(End of certification)

(e) The Contractor shall include the substance of this clause, including this paragraph (e), in each subcontract or purchase under this contract that may involve international air transportation.

(End of clause)

(R 7-104.95 1979 NOV)

(R 1-1.323-2)

101 52.247-7023 TRANSPORTATION OF SUPPLIES BY SEA (NOV 1995)

(a) Definitions. As used in this clause--

(1) "Components" means articles, materials, and supplies incorporated directly into end products at any level of manufacture, fabrication, or assembly by the Contractor or any subcontractor.

(2) "Department of Defense (DoD)" means the Army, Navy, Air Force, Marine Corps, and defense agencies.

(3) "Foreign flag vessel" means any vessel that is not a U.S.-flag vessel.

(4) "Ocean transportation" means any transportation aboard a ship, vessel, boat, barge, or ferry through international waters.

(5) "Subcontractor" means a supplier, materialman, distributor, or vendor at any level below the prime contractor whose contractual obligation to perform results from, or is conditioned upon, award of the prime contract and who is performing any part of the work or other requirement of the prime contract. However, effective May 1, 1996, the term does not include a supplier, materialman, distributor, or vendor of commercial items or commercial components.

(6) "Supplies" means all property, except land and interests in land, that is clearly identifiable for eventual use by or owned by the DoD at the time of transportation by sea.

(i) An item is clearly identifiable for eventual use by the DoD if, for example, the contract documentation contains a reference to a DoD contract number or a military destination.

(ii) Supplies includes (but is not limited to) public works; buildings and facilities; ships; floating equipment and vessels of

every character, type, and description, with parts, subassemblies, accessories, and equipment; machine tools; material; equipment; stores of all kinds; end items; construction materials; and components of the foregoing.

(7) "U.S.-flag vessel" means a vessel of the United States or belonging to the United States, including any vessel registered or having national status under the laws of the United States.

(b) The Contractor shall employ U.S.-flag vessels in the transportation by sea of any supplies to be furnished in the performance of this contract. The Contractor and its subcontractors may request that the Contracting Officer authorize shipment in foreign-flag vessels, or designate available U.S.-flag vessels, if the Contractor or a subcontractor believes that--

- (1) U.S.-flag vessels are not available for timely shipment;
- (2) The freight charges are inordinately excessive or unreasonable; or
- (3) Freight charges are higher than charges to private persons for transportation of like goods.

(c) The Contractor must submit any request for use of other than U.S.-flag vessels in writing to the Contracting Officer at least 45 days prior to the sailing date necessary to meet its delivery schedules. The Contracting Officer will process requests submitted after such date(s) as expeditiously as possible, but the Contracting Officer's failure to grant approvals to meet the shipper's sailing date will not of itself constitute a compensable delay under this or any other clause of this contract.

Requests shall contain at a minimum--

- (1) Type, weight, and cube of cargo;
- (2) Required shipping date;
- (3) Special handling and discharge requirements;
- (4) Loading and discharge points;
- (5) Name of shipper and consignee;
- (6) Prime contract number; and
- (7) A documented description of efforts made to secure U.S.-flag vessels, including points of contact (with names and telephone numbers) with at least two U.S.-flag carriers contacted. Copies of telephone notes, telegraphic and facsimile message or letters will be sufficient for this purpose.

(d) The Contractor shall, within 30 days after each shipment covered by this clause, provide the Contracting Officer and the Division of National Cargo, Office of Market Development, Maritime Administration, U.S. Department of Transportation, Washington, DC 20590, one copy of the rated on board vessel operating carrier's ocean bill of lading, which shall contain the following information--

- (1) Prime contract number;
- (2) Name of vessel;

- (3) Vessel flag of registry;
- (4) Date of loading;
- (5) Port of loading;
- (6) Port of final discharge;
- (7) Description of commodity;
- (8) Gross weight in pounds and cubic feet if available;
- (9) Total ocean freight in U.S. dollars; and
- (10) Name of the steamship company.

(e) The Contractor agrees to provide with its final invoice under this contract a representation that to the best of its knowledge and belief--

- (1) No ocean transportation was used in the performance of this contract;
- (2) Ocean transportation was used and only U.S.-flag vessels were used for all ocean shipments under the contract;
- (3) Ocean transportation was used, and the Contractor had the written consent of the Contracting Officer for all non-U.S.-flag ocean transportation; or
- (4) Ocean transportation was used and some or all of the shipments were made on non-U.S.-flag vessels without the written consent of the Contracting Officer. The Contractor shall describe these shipments in the following format:

Item		Contract	
Description		Line Items	Quantity
Total.....			

(f) If the final invoice does not include the required representation, the Government will reject and return it to the Contractor as an improper invoice for the purposes of the Prompt Payment clause of this contract. In the event there has been unauthorized use of non-U.S.-flag vessels in the performance of this contract, the Contracting Officer is entitled to equitably adjust the contract, based on the unauthorized use.

(g) The Contractor shall include this clause, including this paragraph (g) in all subcontracts under this contract, which exceed the simplified acquisition threshold in Part 13 of the Federal Acquisition Regulation.

(End of clause)

(a) The Contractor has indicated by the response to the solicitation

provision, Representation of Extent of Transportation by Sea, that it did not anticipate transporting by sea any supplies. If, however, after the award of this contract, the Contractor learns that supplies, as defined in the Transportation of Supplies by Sea clause of this contract, will be transported by sea, the Contractor--

(1) Shall notify the Contracting Officer of that fact; and

(2) Hereby agrees to comply with all the terms and conditions of the Transportation of Supplies by Sea clause of this contract.

(b) The Contractor shall include this clause, including this paragraph (b), revised as necessary to reflect the relationship of the contracting parties, in all subcontracts hereunder, except (effective May 1, 1996) subcontracts for the acquisition of commercial items or components.

(End of clause)

103 52.248-3 I VALUE ENGINEERING--CONSTRUCTION (MAR 1989)--ALTERNATE I (APR 1984)

(a) General. The Contractor is encouraged to develop, prepare, and submit value engineering change proposals (VECP's) voluntarily. The Contractor shall share in any instant contract savings realized from accepted VECP's, in accordance with paragraph (f) below.

(b) Definitions. "Collateral costs," as used in this clause, means agency costs of operation, maintenance, logistic support, or Government-furnished property.

"Collateral savings," as used in this clause, means those measurable net reductions resulting from a VECP in the agency's overall projected collateral costs, exclusive of acquisition savings, whether or not the acquisition cost changes.

"Contractor's development and implementation costs," as used in this clause, means those costs the Contractor incurs on a VECP specifically in developing, testing, preparing, and submitting the VECP, as well as those costs the Contractor incurs to make the contractual changes required by Government acceptance of a VECP.

"Government costs," as used in this clause, means those agency costs that result directly from developing and implementing the VECP, such as any net increases in the cost of testing, operations, maintenance, and logistic support. The term does not include the normal administrative costs of processing the VECP.

"Instant contract savings," as used in this clause, means the estimated reduction in Contractor cost of performance resulting from acceptance of the VECP, minus allowable Contractor's development and implementation costs, including subcontractors' development and implementation costs (see paragraph (h) below).

"Value engineering change proposal (VECP)" means a proposal that--

(1) Requires a change to this, the instant contract, to implement; and  
(2) Results in reducing the contract price or estimated cost without impairing essential functions or characteristics; provided, that it does not involve a change--

- (i) In deliverable end item quantities only; or
- (ii) To the contract type only.

(c) VECP preparation. As a minimum, the Contractor shall include in each VECP the information described in subparagraphs (1) through (7) below. If the proposed change is affected by contractually required configuration management or similar procedures, the instructions in those procedures relating to format, identification, and priority assignment shall govern VECP preparation. The VECP shall include the following:

(1) A description of the difference between the existing contract requirement and that proposed, the comparative advantages and disadvantages of each, a justification when an item's function or characteristics are being altered, and the effect of the change on the end item's performance.

(2) A list and analysis of the contract requirements that must be changed if the VECP is accepted, including any suggested specification revisions.

(3) A separate, detailed cost estimate for (i) the affected portions of the existing contract requirement and (ii) the VECP. The cost reduction associated with the VECP shall take into account the Contractor's allowable development and implementation costs, including any amount attributable to subcontracts under paragraph (h) below.

(4) A description and estimate of costs the Government may incur in implementing the VECP, such as test and evaluation and operating and support costs.

(5) A prediction of any effects the proposed change would have on collateral costs to the agency.

(6) A statement of the time by which a contract modification accepting the VECP must be issued in order to achieve the maximum cost reduction, noting any effect on the contract completion time or delivery schedule.

(7) Identification of any previous submissions of the VECP, including the dates submitted, the agencies and contract numbers involved, and previous Government actions, if known.

(d) Submission. The Contractor shall submit VECP's to the Resident Engineer at the worksite, with a copy to the Contracting Officer.

(e) Government action. (1) The Contracting Officer shall notify the Contractor of the status of the VECP within 45 calendar days after the contracting office receives it. If additional time is required, the Contracting Officer shall notify the Contractor within the 45-day period

and provide the reason for the delay and the expected date of the decision. The Government will process VECP's expeditiously; however, it shall not be liable for any delay in acting upon a VECP.

(2) If the VECP is not accepted, the Contracting Officer shall notify the Contractor in writing, explaining the reasons for rejection. The Contractor may withdraw any VECP, in whole or in part, at any time before it is accepted by the Government. The Contracting Officer may require that the Contractor provide written notification before undertaking significant expenditures for VECP effort.

(3) Any VECP may be accepted, in whole or in part, by the Contracting Officer's award of a modification to this contract citing this clause. The Contracting Officer may accept the VECP, even though an agreement on price reduction has not been reached, by issuing the Contractor a notice to proceed with the change. Until a notice to proceed is issued or a contract modification applies a VECP to this contract, the Contractor shall perform in accordance with the existing contract. The Contracting Officer's decision to accept or reject all or part of any VECP shall be final and not subject to the Disputes clause or otherwise subject to litigation under the Contract Disputes Act of 1978 (41 U.S.C. 601-613).

(f) Sharing. (1) Rates. The Government's share of savings is determined by subtracting Government costs from instant contract savings and multiplying the result by (i) 45 percent for fixed-price contracts or (ii) 75 percent for cost-reimbursement contracts.

(2) Payment. Payment of any share due the Contractor for use of a VECP on this contract shall be authorized by a modification to this contract to--

(i) Accept the VECP;

(ii) Reduce the contract price or estimated cost by the amount of instant contract savings; and

(iii) Provide the Contractor's share of savings by adding the amount calculated to the contract price or fee.

(g) Subcontracts. The Contractor shall include an appropriate value engineering clause in any subcontract of \$50,000 or more and may include one in subcontracts of lesser value. In computing any adjustment in this contract's price under paragraph (f) above, the Contractor's allowable development and implementation costs shall include any subcontractor's allowable development and implementation costs clearly resulting from a VECP accepted by the Government under this contract, but shall exclude any value engineering incentive payments to a subcontractor. The Contractor may choose any arrangement for subcontractor value engineering incentive payments; provided, that these payments shall not reduce the Government's share of the savings resulting from the VECP.

(h) Data. The Contractor may restrict the Government's right to use any

part of a VECP or the supporting data by marking the following legend on the affected parts:

"These data, furnished under the Value Engineering--Construction clause of contract \_\_\_\_\_, shall not be disclosed outside the Government or duplicated, used, or disclosed, in whole or in part, for any purpose other than to evaluate a value engineering change proposal submitted under the clause. This restriction does not limit the Government's right to use information contained in these data if it has been obtained or is otherwise available from the Contractor or from another source without limitations."

If a VECP is accepted, the Contractor hereby grants the Government unlimited rights in the VECP and supporting data, except that, with respect to data qualifying and submitted as limited rights technical data, the Government shall have the rights specified in the contract modification implementing the VECP and shall appropriately mark the data. (The terms "unlimited rights" and "limited rights" are defined in Part 27 of the Federal Acquisition Regulation.)

(End of clause)

#### 104 52.249-2 I TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (FIXED-PRICE) (SEP 1996)--

##### ALTERNATE I (SEP 1996)

(a) The Government may terminate performance of work under this contract in whole or, from time to time, in part if the Contracting Officer determines that a termination is in the Government's interest. The Contracting Officer shall terminate by delivering to the Contractor a Notice of Termination specifying the extent of termination and the effective date.

(b) After receipt of a Notice of Termination, and except as directed by the Contracting Officer, the Contractor shall immediately proceed with the following obligations, regardless of any delay in determining or adjusting any amounts due under this clause:

- (1) Stop work as specified in the notice.
- (2) Place no further subcontracts or orders (referred to as subcontracts in this clause) for materials, services, or facilities, except as necessary to complete the continued portion of the contract.
- (3) Terminate all subcontracts to the extent they relate to the work terminated.
- (4) Assign to the Government, as directed by the Contracting Officer, all right, title, and interest of the Contractor under the subcontracts terminated, in which case the Government shall have the right to settle

or to pay any termination settlement proposal arising out of those terminations.

(5) With approval or ratification to the extent required by the Contracting Officer, settle all outstanding liabilities and termination settlement proposals arising from the termination of subcontracts; the approval or ratification will be final for purposes of this clause.

(6) As directed by the Contracting Officer, transfer title and deliver to the Government (i) the fabricated or unfabricated parts, work in process, completed work, supplies, and other material produced or acquired for the work terminated, and (ii) the completed or partially completed plans, drawings, information, and other property that, if the contract had been completed, would be required to be furnished to the Government.

(7) Complete performance of the work not terminated.

(8) Take any action that may be necessary, or that the Contracting Officer may direct, for the protection and preservation of the property related to this contract that is in the possession of the Contractor and in which the Government has or may acquire an interest.

(9) Use its best efforts to sell, as directed or authorized by the Contracting Officer, any property of the types referred to in subparagraph (b)(6) of this clause; provided, however, that the Contractor (i) is not required to extend credit to any purchaser and (ii) may acquire the property under the conditions prescribed by, and at prices approved by, the Contracting Officer. The proceeds of any transfer or disposition will be applied to reduce any payments to be made by the Government under this contract, credited to the price or cost of the work, or paid in any other manner directed by the Contracting Officer.

(c) The Contractor shall submit complete termination inventory schedules no later than 120 days from the effective date of termination, unless extended in writing by the Contracting Officer upon written request of the Contractor within this 120-day period.

(d) After expiration of the plant clearance period as defined in Subpart 45.6 of the Federal Acquisition Regulation, the Contractor may submit to the Contracting Officer a list, certified as to quantity and quality, of termination inventory not previously disposed of, excluding items authorized for disposition by the Contracting Officer. The Contractor may request the Government to remove those items or enter into an agreement for their storage. Within 15 days, the Government will accept title to those items and remove them or enter into a storage agreement. The Contracting Officer may verify the list upon removal of the items, or if stored, within 45 days from submission of the list, and shall correct the list, as necessary, before final settlement.



(e) After termination, the Contractor shall submit a final termination settlement proposal to the Contracting Officer in the form and with the certification prescribed by the Contracting Officer. The Contractor shall submit the proposal promptly, but no later than 1 year from the effective date of termination, unless extended in writing by the Contracting Officer upon written request of the Contractor within this 1 year period. However, if the Contracting Officer determines that the facts justify it, a termination settlement proposal may be received and acted on after 1 year or any extension. If the Contractor fails to submit the proposal within the time allowed, the Contracting Officer may determine, on the basis of information available, the amount, if any, due the Contractor because of the termination and shall pay the amount determined.

(f) Subject to paragraph (e) of this clause, the Contractor and the Contracting Officer may agree upon the whole or any part of the amount to be paid or remaining to be paid because of the termination. The amount may include a reasonable allowance for profit on work done. However, the agreed amount, whether under this paragraph (f) or paragraph (g) of this clause, exclusive of costs shown in subparagraph (g)(3) of this clause, may not exceed the total contract price as reduced by (1) the amount of payments previously made and (2) the contract price of work not terminated. The contract shall be modified, and the Contractor paid the agreed amount. Paragraph (g) of this clause shall not limit, restrict, or affect the amount that may be agreed upon to be paid under this paragraph.

(g) If the Contractor and Contracting Officer fail to agree on the whole amount to be paid the Contractor because of the termination of work, the Contracting Officer shall pay the Contractor the amounts determined as follows, but without duplication of any amounts agreed upon under paragraph (f) of this clause:

(1) For contract work performed before the effective date of termination, the total (without duplication of any items) of--

(i) The cost of this work;

(ii) The cost of settling and paying termination settlement proposals under terminated subcontracts that are properly chargeable to the terminated portion of the contract if not included in subdivision (g)(1)(i) of this clause; and

(iii) A sum, as profit on subdivision (g)(1)(i) of this clause, determined by the Contracting Officer under 49.202 of the Federal Acquisition Regulation, in effect on the date of this contract, to be fair and reasonable; however, if it appears that the Contractor would have sustained a loss on the entire contract had it been completed, the Contracting Officer shall allow no profit under this subdivision (iii) and shall reduce the settlement to reflect the indicated rate of loss.

(2) The reasonable costs of settlement of the work terminated,

including--

(i) Accounting, legal, clerical, and other expenses reasonably necessary for the preparation of termination settlement proposals and supporting data;

(ii) The termination and settlement of subcontracts (excluding the amounts of such settlements); and

(iii) Storage, transportation, and other costs incurred, reasonably necessary for the preservation, protection, or disposition of the termination inventory.

(h) Except for normal spoilage, and except to the extent that the Government expressly assumed the risk of loss, the Contracting Officer shall exclude from the amounts payable to the Contractor under paragraph (g) of this clause, the fair value, as determined by the Contracting Officer, of property that is destroyed, lost, stolen, or damaged so as to become undeliverable to the Government or to a buyer.

(i) The cost principles and procedures of Part 31 of the Federal Acquisition Regulation, in effect on the date of this contract, shall govern all costs claimed, agreed to, or determined under this clause.

(j) The Contractor shall have the right of appeal, under the Disputes clause, from any determination made by the Contracting Officer under paragraph (e), (g), or (l) of this clause, except that if the Contractor failed to submit the termination settlement proposal or request for equitable adjustment within the time provided in paragraph (e) or (l), respectively, and failed to request a time extension, there is no right of appeal.

(k) In arriving at the amount due the Contractor under this clause, there shall be deducted--

(1) All unliquidated advance or other payments to the Contractor under the terminated portion of this contract;

(2) Any claim which the Government has against the Contractor under this contract; and

(3) The agreed price for, or the proceeds of sale of, materials, supplies, or other things acquired by the Contractor or sold under the provisions of this clause and not recovered by or credited to the Government.

(l) If the termination is partial, the Contractor may file a proposal with the Contracting Officer for an equitable adjustment of the price(s) of the continued portion of the contract. The Contracting Officer shall make any equitable adjustment agreed upon. Any proposal by the Contractor for an equitable adjustment under this clause shall be requested within 90 days from the effective date of termination unless extended in writing by the Contracting Officer.

(m)(1) The Government may, under the terms and conditions it prescribes,

make partial payments and payments against costs incurred by the Contractor for the terminated portion of the contract, if the Contracting Officer believes the total of these payments will not exceed the amount to which the Contractor will be entitled.

(2) If the total payments exceed the amount finally determined to be due, the Contractor shall repay the excess to the Government upon demand, together with interest computed at the rate established by the Secretary of the Treasury under 50 U.S.C. App. 1215(b)(2). Interest shall be computed for the period from the date the excess payment is received by the Contractor to the date the excess is repaid. Interest shall not be charged on any excess payment due to a reduction in the Contractor's termination settlement proposal because of retention or other disposition of termination inventory until 10 days after the date of the retention or disposition, or a later date determined by the Contracting Officer because of the circumstances.

(n) Unless otherwise provided in this contract or by statute, the Contractor shall maintain all records and documents relating to the terminated portion of this contract for 3 years after final settlement. This includes all books and other evidence bearing on the Contractor's costs and expenses under this contract. The Contractor shall make these records and documents available to the Government, at the Contractor's office, at all reasonable times, without any direct charge. If approved by the Contracting Officer, photographs, microphotographs, or other authentic reproductions may be maintained instead of original records and documents.

(End of clause)

105 52.249-10 DEFAULT (FIXED-PRICE CONSTRUCTION) (APR 1984)

(a) If the Contractor refuses or fails to prosecute the work or any separable part, with the diligence that will insure its completion within the time specified in this contract including any extension, or fails to complete the work within this time, the Government may, by written notice to the Contractor, terminate the right to proceed with the work (or the separable part of the work) that has been delayed. In this event, the Government may take over the work and complete it by contract or otherwise, and may take possession of and use any materials, appliances, and plant on the work site necessary for completing the work. The Contractor and its sureties shall be liable for any damage to the Government resulting from the Contractor's refusal or failure to complete the work within the specified time, whether or not the Contractor's right to proceed with the work is terminated. This liability includes any increased costs incurred

by the Government in completing the work.

(b) The Contractor's right to proceed shall not be terminated nor the Contractor charged with damages under this clause, if-

(1) The delay in completing the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor. Examples of such causes include (i) acts of God or of the public enemy, (ii) acts of the Government in either its sovereign or contractual capacity, (iii) acts of another Contractor in the performance of a contract with the Government, (iv) fires, (v) floods, (vi) epidemics, (vii) quarantine restrictions, (viii) strikes, (ix) freight embargoes, (x) unusually severe weather, or (xi) delays of subcontractors or suppliers at any tier arising from unforeseeable causes beyond the control and without the fault or negligence of both the Contractor and the subcontractors or suppliers; and

(2) The Contractor, within 10 days from the beginning of any delay (unless extended by the Contracting Officer), notifies the Contracting Officer in writing of the causes of delay. The Contracting Officer shall ascertain the facts and the extent of delay. If, in the judgment of the Contracting Officer, the findings of fact warrant such action, the time for completing the work shall be extended. The findings of the Contracting Officer shall be final and conclusive on the parties, but subject to appeal under the Disputes clause.

(c) If, after termination of the Contractor's right to proceed, it is determined that the Contractor was not in default, or that the delay was excusable, the rights and obligations of the parties will be the same as if the termination had been issued for the convenience of the Government.

(d) The rights and remedies of the Government in this clause are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

#### 106 52.9999-4008 RETAINAGE--SMALL BUSINESS SUBCONTRACTING REPORTING

Reference is made to contract clause(s) FAR 52.219-9, Small Business and Small Disadvantaged Business Subcontracting Plan and 52.219-16, Liquidated Damages--Small Business Subcontracting Plan. In order to ensure compliance with these clauses, retainage will be withheld from progress payments due the contractor in an amount sufficient to protect the Government's ability to assess Liquidated Damages for failure to submit timely SF 294 and SF 295 reports.

The formula for retainage is as follows:

"Total dollar amount proposed for subcontracting to small

business multiplied by percentage of actual progress on the contract, up to a maximum of 10% of the given progress payment, shall be withheld from the next progress payment due after a contractor fails to submit a required report. If one or more reports have been submitted before such failure, formula for determining the amount of retainage will be adjusted by deducting any amounts reported as subcontracted to small business from the total dollar amount proposed to be subcontracted and the difference multiplied by the percent of actual progress, up to a maximum of 10% of the given progress payment."

107 52.9999-4019 PROMPT PAYMENT FOR CONSTRUCTION CONTRACTS (APR 1989) FAR 52.232-27

(93-DEV-08)

Notwithstanding any other payment terms in this contract, the Government will make invoice payments and contract financing payments under the terms and conditions specified in this clause. Payment shall be considered as being made on the day a check is dated or an electronic funds transfer is made. Definitions of pertinent terms are set forth in 32.902. All days referred to in this clause are calendar days, unless otherwise specified.

(a) Invoice Payments. (1) For purpose of this clause, there are several types of invoice payments which may occur under this contract, as follows:

(i) Progress payments, if provided for elsewhere in this contract, based on Contracting Officer approval of the estimated amount and value of work or services performed, including payments for reaching milestones in any project:

(A) The due date for making such payments shall be 14 days after receipt of the payment request by the designated billing office. However, if the designated billing office fails to annotate the payment request with the actual date of receipt, the payment due date shall be deemed to be the 14th day after the date the Contractor's payment request is dated, provided a proper payment request is received and there is no disagreement over quantity, quality, or Contractor compliance with contract requirements.

(B) The due date for payment of any amounts retained by the Contracting Officer in accordance with the clause at 52.232-5, Payments Under Fixed-Price Construction Contracts, shall be as specified in the contract or, if not specified, 30 days after approval for release to the Contractor by the Contracting Officer.

(ii) Final payments based on completion and acceptance of all work and

presentation of release of all claims against the Government arising by virtue of the contract, and payments for partial deliveries that have been accepted by the Government (e.g., each separate building, public work, or other division of the contract for which the price is stated separately in the contract).

(A) The due date for making such payments shall be either the 30th day after receipt by the designated billing office of a proper invoice from the Contractor, or the 30th day after Government acceptance of the work or services completed by the Contractor, whichever is later. However, if the designated billing office fails to annotate the invoice with the date of actual receipt, the invoice payment due date shall be deemed to be the 30th day after the date the Contractor's invoice is dated, provided a proper invoice is received and there is no disagreement over quantity, quality, or Contractor compliance with contract requirements.

(B) On a final invoice where the payment amount is subject to contract settlement actions (e.g., release of claims), acceptance shall be deemed to have occurred on the effective date of the contract settlement.

(2) An invoice is the Contractor's bill or written request for payment under the contract for work or services performed under the contract. An invoice shall be prepared and submitted to the designated billing office. A proper invoice must include the items listed in subdivisions (a)(2)(i) through (a)(2)(ix) of this clause. If the invoice does not comply with these requirements, the Contractor will be notified of the defect within 7 days after receipt of the invoice at the designated billing office. Untimely notification will be taken into account in the computation of any interest penalty owed the Contractor the manner described in subparagraph (a)(4) of this clause:

- (i) Name and address of the Contractor.
- (ii) Invoice date.
- (iii) Contract number or other authorization for work or services performed (including order number and contract line item number).
- (iv) Description of work or services performed.
- (v) Delivery and payment terms (e.g., prompt payment discount terms).
- (vi) Name and address of Contractor official to whom payment is to be sent (must be the same as that in the contract or in a proper notice of assignment).
- (vii) Name (where practicable), title, phone number, and mailing address of person to be notified in event of a defective invoice.
- (viii) For payments described in subdivision (a)(1)(i) of this clause, substantiation of the amounts requested and certification in accordance with the requirements of the clause at 52.232-5, Payments Under Fixed-Price Construction Contracts.
- (ix) Any other information or documentation required by the contract.

(3) An interest penalty shall be paid automatically by the designated payment office, without request from the Contractor, if payment is not made by the due date and the conditions listed in subdivision (a)(3)(i) through (a)(3)(iii) of this clause are met, if applicable.

(i) A proper invoice was received by the designated billing office.

(ii) A receiving report or other Government documentation authorizing payment was processed and there was no disagreement over quality, Contractor compliance with any contract term or condition, or requested progress payment amount.

(iii) In the case of a final invoice for any balance of funds due the Contractor for work or services performed, the amount was not subject to further contract settlement actions between the Government and the Contractor.

(4) The interest penalty shall be at the rate established by the Secretary of the Treasury under section 12 of the Contract Disputes Act of 1978 (41 U.S.C. 611) that is in effect on the day after the due date, except where the interest penalty is prescribed by other governmental authority. This rate is referred to as the "Renegotiation Board Interest Rate," and it is published in the Federal Register semiannually on or about January 1 and July 1. The interest penalty shall accrue daily on the invoice payment amount approved by the Government and be compounded in 30-day increments inclusive from the first day after the due date through the payment date. That is, interest accrued at the end of any 30-day period will be added to the approved invoice payment amount and be subject to interest penalties if not paid in the succeeding 30-day period. If the designated billing office failed to notify the Contractor of a defective invoice within the periods prescribed in subparagraphs (a)(2) of this clause, then the due date on the corrected invoice will be adjusted by subtracting the number of days taken beyond the prescribed notification of defects period. Any interest penalty owed the Contractor will be based on this adjusted due date. Adjustments will be made by the designated payment office for errors in calculating interest penalties, if requested by the Contractor.

(i) For the sole purpose of computing an interest penalty that might be due the Contractor for payments described in subdivision (a)(1)(ii) of this clause, Government acceptance or approval shall be deemed to have occurred constructively on the 7th day after the Contractor has completed the work or services in accordance with the terms and conditions of the contract. In the event that actual acceptance or approval occurs within the constructive acceptance or approval period, the determination of an interest penalty shall be based on the actual date of acceptance or approval. Constructive acceptance or constructive approval requirements do not apply if there is a disagreement over quantity, quality, or Contractor

compliance with a contract provision. These requirements also do not compel Government officials to accept work or services, approve Contract estimates, perform contract administration functions, or make payment prior to fulfilling their responsibilities.

(ii) The following periods of time will not be included in the determination of an interest penalty:

(A) The period taken to notify the Contractor of defects in invoices submitted to the Government, but this may not exceed 7 days.

(B) The period between the defects notice and resubmission of the corrected invoice by the Contractor.

(iii) Interest penalties will not continue to accrue after the filing of a claim for such penalties under the clause at 52.233-1, Disputes, or for more than 1 year. Interest penalties of less than \$1.00 need not be paid.

(iv) Interest penalties are not required on payment delays due to disagreement between the Government and Contractor over the payment amount or other issues involving contract compliance, or on amounts temporarily withheld or retained in accordance with the terms of the contract. Claims involving disputes, and any interest that may be payable, will be resolved in accordance with the clause at 52.233-1, Disputes.

(5) An interest penalty shall also be paid automatically by the designated payment office, without request from the Contractor, if a discount for prompt payment is taken improperly. The interest penalty will be calculated on the amount of discount taken for the period beginning with the first day after the end of the discount period through the date when the Contractor is paid.

(6) If this contract was awarded on or after October 1, 1989, a penalty amount, calculated in accordance with regulations issued by the Office of Management and Budget, shall be paid in addition to the interest penalty amount if the Contractor:

(i) Is owed an interest penalty;

(ii) Is not paid the interest penalty within 10 days after the date the invoice amount is paid; and

(iii) Makes a written demand, not later than 40 days after the date the invoice amount is paid, that the agency pay such a penalty.

(b) Contract Financing Payments. (1) For purposes of this clause, if applicable, "contract financing payments" means a Government disbursement of monies to a Contractor under a contract clause or other authorization prior to acceptance of supplies or services by the Government, other than progress payments based on estimates of amount and value of work performed. Contract financing payments include advance payments and interim payments under cost-type contracts.

(2) If this contract provides for contract financing, requests for



payment shall be submitted to the designated billing office as specified in this contract or as directed by the Contracting officer. Contract financing payments shall be made on the 30th day after receipt of a proper contract financing request by the designated billing office. In the event that an audit or other review of a specific financing request is required to ensure compliance with the terms and conditions of the contract, the designated payment office is not compelled to make payment by the due date specified. For advance payments, loans, or other arrangements that do not involve recurrent submission of contract financing requests, payment shall be made in accordance with the corresponding contract terms or as directed by the Contracting Officer. Contract financing payments shall not be assessed an interest penalty for payment delays.

(c) The Contractor shall include in each subcontract for property or services (including a material supplier) for the purpose of performing this contract, the following.

(1) A payment clause which obligates the Contractor to pay the subcontractor for satisfactory performance under its subcontract not later than 7 days from receipt of payment out of such amounts as are paid to the Contractor under the contract.

(2) An interest penalty clause obligates the Contractor to pay to the subcontractor an interest penalty for each payment not more in accordance with the payment clause:

(i) For the period beginning on the day after the required payment date and ending on the date on which payment of the amount due is made; and

(ii) Computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contract Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligations to pay an interest penalty.

(3) A clause requiring each subcontractor to include a payment clause and an interest penalty clause conforming to the standards set forth in subparagraphs (c)(1) and (c)(2) of this clause in each of its subcontracts, and to require each of its subcontractors to include such clauses in their subcontracts with each lower-tier subcontractor or supplier.

(d) The clauses required by paragraph (c) of this clause shall not be constructed to impair the right of Contractor or a subcontractor at any tier to negotiate, and to include in their subcontract, provisions which:

(1) Permit the Contractor or a subcontractor to retain (without cause) a specified percentage of each progress payment otherwise due to a subcontractor for satisfactory performance under the subcontract without incurring any obligation to pay a late payment interest penalty, in accordance with terms and conditions agreed to by the parties to the subcontract, giving such recognition as the parties deem appropriate to

the ability of a subcontractor to furnish a performance bond and a payment bond.

(2) Permit the Contractor or subcontractor to make determination that part or all of the subcontractor's request for payment may be withheld in accordance with the subcontract agreement; and

(3) Permit such withholding without incurring any obligation to pay a late payment penalty if:

(i) A notice conforming to the standards of paragraph (g) of this clause has been previously furnished to the subcontractor, and

(ii) A copy of any notice issued by a Contractor pursuant to subdivision (d)(3)(i) of this clause has been furnished to the Contracting Officer.

(e) If a Contractor, after making a request for payment to the Government but before making a payment to a subcontractor for the subcontractor's performance covered by the payment request, discovers that all or a portion of the payment otherwise due such subcontractor is subject to withholding from the subcontractor in accordance with the subcontract agreement, then the Contractor shall:

(1) Furnish to the subcontractor a notice conforming to the standards of paragraph (g) of this clause as soon as practicable upon ascertaining the cause giving rise to a withholding, but prior to the due date for subcontractor payment;

(2) Furnish to the Contracting Officer, as soon as practicable, a copy of the notice furnished to the subcontractor pursuant to subparagraph (e)(1) of this clause;

(3) Reduce the subcontractor's progress payment by an amount not to exceed the amount specified in the notice of withholding furnished under subparagraph (e)(1) of this clause;

(4) Pay the subcontractor as soon as practicable after the correction of the identified subcontract performance deficiency, and

(i) Make such payment within:

(A) Seven days after correction of the identified subcontract performance deficiency (unless the funds therefore must be recovered from the Government because of a reduction under subdivision (e)(5)(i) of this clause; or

(B) Seven days after the Contractor recovers such funds from the Government; or

(ii) incur an obligation to pay a late payment interest penalty computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contracts Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty;

(5) Notify the Contracting Officer upon:

(i) Reduction of the amount of any subsequent certified application for payment; or

(ii) Payment to the subcontractor of any withheld amounts of a progress payment, specifying:

(A) The amounts withheld under subparagraph (e)(1) of this clause; and

(B) The dates that such withholding began and ended; and

(6) Be obligated to pay to the Government an amount equal to interest on the withheld payments (computed in the manner provided in 31 U.S.C 3903(c)(1), from the 8th day after receipt of the withheld amounts from the Government until:

(i) The day the identified subcontractor performance deficiency is corrected; or

(ii) The date that any subsequent payment is reduced under subdivision (e)(5)(i) of this clause.

(f)(1) If a Contractor, after making payment to a first-tier subcontractor, receives from a supplier or subcontractor of the first-tier subcontractor (hereafter referred to as a "second-tier subcontractor") a written notice in accordance with section 2 of the Act of August 24, 1935 (40 U.S.C. 270b, Miller Act), asserting a deficiency in such first-tier subcontractor's performance under the contract for which the Contractor may be ultimately liable, and the Contractor determines that all or a portion of future payments otherwise due such first-tier subcontractor is subject to withholding in accordance with the subcontract agreement, then the Contractor may, without incurring an obligation to pay an interest penalty under subparagraph (e)(6) of this clause:

(i) Furnish to the first-tier subcontractor a notice conforming to the standards of paragraph (g) of this clause as soon as practicable upon making such determination; and

(ii) Withhold from the first-tier subcontractor's next available progress payment or payments an amount not to exceed the amount specified in the notice of withholding furnished under subdivision (f)(1)(i) of this clause.

(2) As soon as practicable, but not later than 7 days after receipt of satisfactory written notification that the identified subcontract performance deficiency has been corrected, the Contractor shall pay the amount withheld under subdivision (f)(1)(ii) of this clause to such first-tier subcontractor, or shall incur an obligation to pay a late payment interest penalty to such first-tier subcontractor computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contracts Disputes Act of 1978 (41 U.S.C 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty.

(g) A written notice of any withholding shall be issued to a subcontractor (with a copy to the Contracting Officer of any such notice issued by the Contractor), specifying:

- (1) The amount to be withheld;
- (2) The specific causes for withholding under the terms of the subcontract; and
- (3) The remedial actions to be taken by the subcontractor in order to receive payment of the amounts withheld.

(h) The Contractor may not request payment from the Government of any amount withheld or retained in accordance with paragraph (d) of this clause until such time as the Contractor has determined and certified to the Contracting Officer that the subcontractor is entitled to the payment of such amount.

(i) A dispute between the Contractor and subcontractor relating to the amount or entitlement of a subcontractor to a payment or a late payment interest penalty under a clause included in the subcontract pursuant to paragraph (c) of this clause does not constitute a dispute to which the United States is a party. The United States may not be interpleaded in any judicial or administrative proceeding involving such a dispute.

(j) Except as provided in paragraph (i) of this clause, this clause shall not limit or impair any contractual, administrative, or judicial remedies otherwise available to the Contractor or a subcontractor in the event of a dispute involving late payment or nonpayment by the Contractor or deficient subcontract performance or nonperformance by a subcontractor.

(k) The Contractor's obligation to pay an interest penalty to a subcontractor pursuant to the clauses included in a subcontract under paragraph (c) of this clause shall not be construed to be an obligation of the United States for such interest penalty. A cost reimbursement claim may not include any amount for reimbursement of such interest penalty.

108 52.252-6 AUTHORIZED DEVIATIONS IN CLAUSES (APR 1984)  
(Reference 52.107(f))

END OF SECTION 00700

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## SECTION 00800

### SPECIAL CONTRACT REQUIREMENTS

#### 1 52.0-4303 COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK

(a) The Contractor shall be required to (1) commence work under this contract within 8 calendar days after the date the Contractor receives the notice to proceed, (2) prosecute the work diligently, and (3) complete the entire work ready for use not later than 365 calendar days after receipt of notice to proceed. This time stated for completion shall include final cleanup of the premises.

(b) Provisions stipulated for conducting tests on heating and air conditioning systems and planting and maintenance of grass are excluded from the completion time stated above.

#### 2 52.211-12 LIQUIDATED DAMAGES--CONSTRUCTION (APR 1984)

(a) If the Contractor fails to complete the work within the time specified in the contract, or any extension, the Contractor shall pay to the Government as liquidated damages, the sum of \_\_\_\_\_ for each day of delay.

(b) If the Government terminates the Contractor's right to proceed, the resulting damage will consist of liquidated damages until such reasonable time as may be required for final completion of the work together with any increased costs occasioned the Government in completing the work.

(c) If the Government does not terminate the Contractor's right to proceed, the resulting damage will consist of liquidated damages until the work is completed or accepted.

(End of clause)

#### 3 52.211-13 TIME EXTENSIONS (APR 1984)

Notwithstanding any other provisions of this contract, it is mutually understood that the time extensions for changes in the work will depend upon the extent, if any, by which the changes cause delay in the completion of the various elements of construction. The change order granting the time extension may provide that the contract completion date will be extended only for those specific elements so delayed and that the remaining contract completion dates for all other portions of the work will not be altered and may further provide for an equitable readjustment of liquidated damages under the new completion schedule.

(End of clause)

#### 4 52.225-7004 NONDOMESTIC CONSTRUCTION MATERIALS (DEC 1991)

The requirements of the Buy American Act clause of this contract do not apply to the following items: NONE

(End of clause)

#### 5 52.236-1 PERFORMANCE OF WORK BY THE CONTRACTOR (APR 1984)

The Contractor shall perform on the site, and with its own organization, work equivalent to at least 20 percent of the total amount of work to be performed under the contract. This percentage may be reduced by a supplemental agreement to this contract if, during performing the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the Government.

(End of clause)  
(R 7-603.15 1965 JAN)  
(R 1-18.104)

6 52.236-14 AVAILABILITY AND USE OF UTILITY SERVICES (APR 1984)

(a) The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. The Contractor shall carefully conserve any utilities furnished without charge.

(b) The Contractor, at its expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of each utility used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.

(End of clause)  
(R 7-603.30 1967 APR)  
(R 7-2102.4 1976 OCT)

7 52.236-17 LAYOUT OF WORK (APR 1984)

The Contractor shall lay out its work from Government-established base lines and bench marks indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at its own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through its negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

(End of clause)  
(R 7-604.3 1965 JAN)



(a) The manuals shall be submitted for approval within ninety (90) days after approval of the submittal for the items proposed for procurement unless stated otherwise in the technical specifications. Each manual shall include the following:

(1) Hard Cover Binders. The manuals shall be bound in a 3-ring binder with a hard cover. The following identification shall be inscribed on the cover: the words "EQUIPMENT OPERATING, MAINTENANCE, AND REPAIR MANUAL" and the building name and number, location, and indication of utility or system covered. Manuals shall be approximately 8 1/2 by 11 inches with large sheets folded in and capable of being easily pulled out for reference.

(2) Warning Page. A warning page shall be provided to warn of potential dangers (if they exist), such as high voltage, toxic chemicals, flammable liquids, explosive materials, carcinogens, or high pressures. The warning page shall be placed inside the front cover, in front of the title page.

(3) Title Page. The title page shall show the name, address and phone number of the Contractor, the contract number and the date of publication.

(4) Table of Contents. Provide in accordance with standard commercial practice.

(b) General: Manuals shall include, in separate sections, the following information for each item of equipment and system:

(1) Performance sheets and graphs showing capacity data, efficiencies, electrical characteristics, pressure drops, and flow rates. Marked-up catalogs or catalog pages do not satisfy this requirement. Performance information shall be presented as concisely as possible and contain only data pertaining to equipment actually installed.

(2) Catalog cuts showing application information.

(3) Installation information showing minimum acceptable requirements.

(4) Operation and maintenance requirements. Include adequate illustrative material to identify and locate operating controls, indicating devices and locations of areas or items requiring maintenance.

(a) Describe, in detail, starting and stopping procedures for components, adjustments required to obtain optimum equipment performance, and corrective actions for malfunctions.

(b) Maintenance instructions describing the nature and frequency of routine maintenance and procedures to be followed. Indicate any special tools, materials, and test equipment that may be required.

(5) Repair information including diagrams and schematics, guidance for diagnosing problems, and detailed instructions for making the repairs. Provide troubleshooting information that includes a statement of the indication or symptom of trouble and the sequential instructions necessary. Include test hookups to determine the cause, special tools and test equipment, and methods for returning the equipment to operating conditions. Information may be in chart form or in tabular format with appropriate headings.

(6) Parts list and names and addresses of the two closest parts supply agencies.

(7) Names and addresses of the local manufacturers representatives and the parent company.

(c) Separate manuals shall be provided for each system required by this contract. The systems are defined as follows:

(1) Facility Heating Systems. Information shall be provided on the following equipment: boilers, water treatment, chemical feed pumps and tanks, converters, heat exchanger, pumps, unit heaters, fin-tube radiation, air handling units (both heating only and heating and cooling), and valves (associated with heating systems).

(2) Air-Conditioning Systems. Provide information on chillers, packaged air-conditioning equipment, towers, water treatment, pumps and tanks, air-cooled condensers, pumps, compressors, air handling units, and valves (associated with air-conditioning systems).

(3) Temperature Control and HVAC Distribution Systems.

(a) Provide the information described for the following equipment: valves, fans, air handling units, pumps, boilers, converters and heat exchangers, chillers, water cooled condensers, air-cooled condensers, cooling towers, fin-tube radiation, and radiant heating systems.

(b) Provide all information described for the following equipment: control air compressors, control components (sensors, controllers, adapters and actuators), and water and air flow measuring equipment.

(4) Central Heating Plants. Provide the information described for the following equipment: boilers, converters, heat exchanger, pumps, fans, steam traps, pollution control equipment, chemical feed equipment, control systems, fuel handling equipment, de-aerators, tanks (flash, expansion, return water, etc), water softeners, valves, and fuel-oil storage tanks.

(5) District Heating Distribution Systems. Provide the information described for the following equipment: valves, fans, pumps, converters and heat exchanger, steam traps, tanks (expansion, flash, etc), and piping systems.

(6) Exterior Electrical Systems. Information shall be provided on the following equipment: power transformers, relays, reclosers, breakers, regulators, converters, meters and capacitor bank controls.

(7) Interior Electrical Systems. Information shall be provided on the following equipment: relays, motor control centers, switchgear, solid state circuit breakers, motor controller, regulators, converters, filters, meters and EPS lighting systems.

(a) Wiring diagrams and troubleshooting flow chart on control systems.

(b) Special grounding systems.

(8) Energy Management and Control System. The maintenance manual shall include descriptions of maintenance for all equipment, including inspection, periodic preventative maintenance, fault diagnosis, and repair or replacement of defective components.

(9) Potable Water Treatment Systems. The identified information shall be provided on the following equipment: tanks, unit process equipment, pumps, motors, control and monitoring instrumentation, laboratory test equipment, chemical feeders, valves, switching gear, and automatic controls.

(10) Wastewater Treatment Systems. The identified information shall be provided on the following equipment: tanks, unit process equipment, pumps, motors, control and monitoring instrumentation, laboratory test equipment, chemical feeders, valves, scrapers, skimmers, comminutors, blowers, switching gear, and automatic controls.

(11) Fire Protection Systems. Information shall be provided on the following equipment: alarm valves, manual valves, regulators,

storage tanks, piping materials, sprinkler heads, nozzles, pumps, and pump drivers.

(12) Fire Detection Systems. The maintenance manual shall include description of maintenance for all detectors, control panels, batteries, transmitters, audible and visual alarm signaling devices and any other auxiliary detection or alarm equipment associated with fire detection and alarm system. The manual shall include inspection, test, periodic maintenance, fault diagnosis, and repair or replacement of defective components.

(13) Plumbing Systems. Information shall be provided on the following equipment: water heaters, valves, pressure regulators, backflow preventors, piping materials, and plumbing fixtures.

(14) Liquid Fuels Systems. Information shall be provided on the following equipment: tanks, automatic valves, manual valves, filter separators, pumps, mechanical loading arms, nozzles, meters, electronic controls, electrical switch gear, and fluidics controls.

(15) Cathodic Protection Systems. Information shall be provided on the following material and equipment: rectifiers, meters anodes, anode backfill, anode lead wire, insulation material and wire size, automatic controls (if any), rheostats, switches, fuses and circuit breakers, type and size of rectifying elements, type of oil in oil-immersed rectifiers, and rating of shunts.

(16) Generator Installations. Information shall be provided on the following equipment: generator sets, automatic transfer panels, governors, exciters, regulators, starting systems, switchgear, and protective devices.

(17) Miscellaneous Systems. Information shall be provided on the following: communication and ADP systems, security and intrusion alarm, elevators, motorized doors, kitchen equipment, material handling, active solar, photovoltaic, and other similar type special systems not otherwise specified.

(d) Payment for the equipment or system will be limited to 80% of the cost of the equipment or system and installation until the operating and maintenance manuals are approved.

## 9 52.246-21 WARRANTY OF CONSTRUCTION (MAR 1994)

(a) In addition to any other warranties in this contract, the Contractor warrants, except as provided in paragraph (f) of this clause, that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier.

(b) This warranty shall continue for a period of 1 year from the date of final acceptance of the work. If the Government takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the Government takes possession.

(c) The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Government-owned or controlled real or personal property, when that damage is the result of--

(1) The Contractor's failure to conform to contract requirements; or

(2) Any defect of equipment, material, workmanship, or design furnished.

(d) The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to

work repaired or replaced will run for 1 year from the date of repair or replacement.

(e) The Contracting Officer shall notify the Contractor, in writing, within a reasonable time after the discovery of any failure, defect, or damage.

(f) If the Contractor fails to remedy any failure, defect, or damage within a reasonable time after receipt of notice, the Government shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

(g) With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall--

(1) Obtain all warranties that would be given in normal commercial practice;

(2) Require all warranties to be executed, in writing, for the benefit of the Government, if directed by the Contracting Officer; and

(3) Enforce all warranties for the benefit of the Government, if directed by the Contracting Officer.

(h) In the event the Contractor's warranty under paragraph (b) of this clause has expired, the Government may bring suit at its expense to enforce a subcontractor's, manufacturer's, or supplier's warranty.

(i) Unless a defect is caused by the negligence of the Contractor or subcontractor or supplier at any tier, the Contractor shall not be liable for the repair of any defects of material or design furnished by the Government nor for the repair of any damage that results from any defect in Government-furnished material or design.

(j) This warranty shall not limit the Government's rights under the Inspection and Acceptance clause of this contract with respect to latent defects, gross mistakes, or fraud.

(End of clause)

(R 7-604.4 1976 JUL)

## 10 52.0-4328 ENFORCEMENT OF WARRANTIES

### (1) Performance Bond.

(a) It is understood that the Contractor's Performance Bond will remain effective throughout the life of all warranties and warranty extensions

(b) In the event the Contractor or his designated representative fails to commence and diligently pursue any work required under the Special Clause entitled "Warranty of Construction" within a reasonable time after receipt of written notification pursuant to the requirements thereof, the Contracting Officer shall have a right to demand that said work be performed under the Performance Bond by making written notice on the surety. If the surety fails or refuses to perform the obligation it assumed under the Performance Bond, the Contracting Officer shall have the work performed by others, and after completion of the work, shall make demand for reimbursement of any or all expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

(c) Warranty repair work which arises to threaten the health or safety of personnel, the physical safety of property or equipment, or which impairs operations, habitability of living spaces, etc., will be handled by the Contractor on an immediate basis as directed verbally by the Contracting Officer or his authorized representative. Written verification

will follow verbal instructions. Failure of the Contractor to respond as verbally directed will be cause for the Contracting Officer or his authorized representative to have the warranty repair work performed by others and to proceed against the Contractor as outlined in paragraph b, above.

(2) Pre-Warranty Conference. Prior to contract completion and at a time designated by the Contracting Officer or his authorized representative, the Contractor shall meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of the Special Clause entitled "Warranty of Construction" of this specification. Communication procedures for Contractor notification of warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer or his authorized representative for the execution of the construction warranty shall be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, the Contractor will furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue warranty work action on behalf of the Contractor. This single point of contact will be located within the local service area of the warranted construction, will be continuously available, and will be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of his responsibilities in connection with the Special Clause entitled "Warranty of Construction."

#### 11 52.0-4301 SUBMITTAL OF WORK TO BE PERFORMED BY CONTRACTOR

The Contractor shall furnish the Contracting Officer within ten days after award the items of work he will perform with his own forces and the estimated cost of those items. The percentage of work that must be performed by the Contractor is stated in the Special Clause entitled, "PERFORMANCE OF WORK BY THE CONTRACTOR."

#### 12 52.0-4309 CERTIFICATES OF COMPLIANCE

Any certificates required for demonstrating proof of compliance of materials with specification requirements shall be executed in four copies. Each certificate shall be signed by an official authorized to certify on behalf of the manufacturing company and shall contain the name and address of the Contractor, the project name and location, and the quantity and date or dates of shipment or delivery to which the certificates apply. Copies of laboratory test reports submitted with certificates shall contain the address of the testing laboratory and the date or dates of the tests to which the report applies. Certification shall not be construed as relieving the Contractor from furnishing satisfactory material, if, after tests are performed on selected samples, the material is found not to meet the specific requirements.

#### 13 52.0-4310 TEMPORARY ELECTRICAL SERVICE

All temporary electrical service on the project, and within all temporary and permanent structures shall be installed and maintained in

compliance with the provisions of EM 385-1-1, dated October 1992, Corps of Engineers Safety and Health Requirements, and APPENDIX T of Mobile District Regulation 385-1-1, Electrical Service Requirements for Construction and Maintenance Operations. Copies of these publications are available for inspection in the District Office by Prospective bidders, and will be furnished to the successful bidder.

#### 14 52.0-4312 AIR FORCE PROJECT SIGN

The Contractor shall furnish and install a project sign at the location designated by the Contracting Officer within 30 days after notice to proceed. The sign shall be constructed with a face sheet of 1/2-inch thick, grade A-C, exterior plywood mounted on a substantial framework of treated wood, sized and detailed as shown on Figure 4E, Erection Details, bound herein. Lettering, color, and paint shall conform to the details shown in Figure 4C, Construction Sign, bound herein. The sign shall receive one coat of primer paint followed by 2 coats of gloss exterior enamel. Lettering shall be with gloss exterior enamel. The HQ USAF Engineering and Services Directorate Emblem shall be provided by the Contractor, and shall be acquired through the Federal Industries (ENCOR), the Fort Leavenworth sign shop, or commercial sources. The Contractor shall coordinate emblem acquisition with the Base Civil Engineer. The Contractor shall maintain the sign in a "like new" condition throughout the life of the project, repainting and replacing members as necessary to accomplish this requirement. Upon completion of the work under this contract, the project sign shall be removed from the job site and shall remain the property of the Contractor. No direct payment will be made for the sign nor for maintenance of the sign.

#### 15 52.0-4313 BULLETIN BOARD

Immediately upon beginning of work under this contract, the Contractor shall provide at the job site a weatherproof glass-covered bulletin board for displaying the fair employment poster, wage rates, and safety bulletins and posters. Emergency telephone numbers and reporting instructions for ambulance, physician, hospital, fire and police shall be posted. The bulletin board shall be located in a conspicuous place easily accessible to all and legible copies of the aforementioned data shall be displayed until work under the contract is completed. No direct payment will be made for the bulletin board.

#### 16 52.0-4316 PRESERVATION OF HISTORICAL, ARCHEOLOGICAL AND CULTURAL RESOURCES

(a) If known historical, archeological and cultural resources exist within the Contractor's work area, they have been designated on the contract drawings. The Contractor shall install protection for these resources as shown on the drawings and shall be responsible for their preservation during the contract.

(b) If, during construction activities, the Contractor observes items that might have historical or archeological value, such observations shall be reported immediately to the Contracting Officer so that the appropriate authorities may be notified and a determination can be made as to their

significance and what, if any, special disposition of the finds should be made. The Contractor shall cease all activities that may result in the destruction of these resources and shall prevent his employees from trespassing on, removing, or otherwise damaging such resources.

#### 17 52.0-4317 REQUIRED INSURANCE

The Contractor shall procure and maintain during the entire period of his performance under this contract, the following minimum insurance in accordance with the Contract Clause entitled "Insurance-Work on a Government Installation."

Workmen's Compensation and Employers' liability Insurance:

Workmen's Compensation and Occupational Disease Coverage in accordance with statutory limits. Employers' Liability Coverage with a minimum limit of \$100,000.

Comprehensive Automobile Liability Insurance:

Bodily injury coverage with minimum limits of \$200,000 per person and \$500,000 per occurrence. property Damage Coverage with a minimum limit of \$20,000 per occurrence.

Comprehensive General Liability Insurance:

Bodily injury coverage with minimum limits of \$500,000 per occurrence.

#### 18 52.0-4320 WORK IN QUARANTINED AREA

The work called for by this contract involves activities in counties quarantined by the Department of Agriculture to prevent the spread of certain plant pests which may be present in the soil. The Contractor agrees that all construction equipment and tools to be moved from such counties shall be thoroughly cleaned of all soil residues at the construction site with water under pressure and that hand tools shall be thoroughly cleaned by brushing or other means to remove all soil. In addition, if this contract involves the identification, shipping, storage, testing, or disposal of soils from such a quarantined area, the Contractor agrees to comply with the provisions of ER 1110-1-5 and attachments, a copy of which will be made available by the Contracting Officer upon request. The Contractor agrees to assure compliance with this obligation by all subcontractors.

#### 19 52.0-4322 COLOR BOARDS FOR AIR FORCE PROJECTS

(a) The Contractor shall submit six sets of color boards and finish samples at one time within 90 days after the construction contract notice to proceed, but more than 30 days prior to ordering materials. The

(b) This sample submittal package shall include all visible exterior and interior materials and finishes which are a part of the building structure or built-in items to be provided by the contract. Provide the samples on 8-1/2 - X 11-inch board modules with a maximum spread of 25-1/2 - X 33 inches for foldouts. Label the modules with the project titles and design them to fit in a standard loose-leaf, three-post binder. The modules shall support and anchor all samples. Anchor large or heavy samples with mechanical fasteners. Organize the submittals in a logical manner to allow a fast review. Write descriptions and

explanations clearly. Drawings and photographs must be clear and concise. Organize samples by scheme with a separate scheme for each room or for groups of rooms with the same scheme. Coordinate the schemes by room names and numbers shown on the architectural floor plans and room finish and color schedule. Include floor plans and schedules in modules. Indicate true pattern color and texture for interior material and finish samples. Carpet samples should be large enough to indicate a complete pattern or design, but not less than 3 by 5 inches. Include color/finish pattern and texture for exterior materials and finishes. Provide at least a 12 inch square sample where either interior or exterior special finishes such as architectural concrete or prefinished textured metal panels, are required.

(c) Submittal of the color samples shall not relieve the Contractor of the responsibility to submit the samples required by the Technical Provisions.

(d) The Contractor shall obtain approval of the total construction color boards before he starts any finish work involving any item included on the submission.

## 20 52.0-4323 EQUIPMENT DATA

(a) Major Equipment. The Contractor shall be required to make a list of all installed equipment furnished under this contract. This list shall include but not be limited to each piece of equipment which has a serial number. This list shall include all information usually listed on manufacturer's name plate, so as to positively identify the piece of property. This list shall also include the cost of each piece of installed property (less installation costs) F.O.B. construction site. The above referenced list shall be furnished as soon as possible after equipment is purchased. The list shall be furnished as one (1) reproducible and three (3) copies and shall be furnished to Contracting Officer not later than thirty calendar days prior to completion of any segment of the contract work which has an incremental completion date. Listing will be on Government furnished MOB Form 897, available from the Contracting Officer.

(b) Other Equipment. The Contractor will be required to furnish a brochure, catalog cut, parts list, manufacturer's data sheet or other publication (including the manufacturer's name and address) which will show detailed parts data on all other equipment, such as hardware, plumbing and lighting fixtures, etc., subject to repair and maintenance procedures. The data shall be furnished in four (4) copies to the Contracting Officer not later than thirty calendar days prior to completion of any segment of the contract work which has an incremental completion date.

## 21 52.0-4324 SCHEDULE OF AVAILABLE UTILITIES

In accordance with paragraph entitled availability and use of utility services, the Government will make available at no cost to the Contractor, electricity and water from existing distribution lines, outlets and supplies. It shall be the Contractor's responsibility to install and maintain all necessary temporary connections and distribution lines for his own use. Any other required utilities shall be furnished by the Contractor.



22 52.0-4325 IDENTIFICATION OF EMPLOYEES

The Contractor shall be responsible for furnishing an identification badge card to each employee prior to the employee's work on-site, and for requiring each employee engaged on the work to display such identification as may be approved and directed by the Contracting Officer. All prescribed identification shall immediately be delivered to the Contracting Officer for cancellation upon the release of any employee. When required by the Contracting Officer, the Contractor shall obtain and submit fingerprints of all persons employed or to be employed on the project.

23 52.0-4326 PAYMENT FOR MATERIALS DELIVERED OFFSITE (MAR 1995)  
EFARS 52.232-5000

(a) Pursuant to FAR Clause 52.232-5, "Payment Under Fixed-Price Construction Contracts," materials delivered to the Contractor at locations other than the site of the work may be taken into consideration in making payments if included in payment estimates and if all the conditions of the contract clauses are fulfilled. Payment for items delivered to locations other than the work site will be limited to (1) materials required by the technical provisions; or (2) materials that have been fabricated to the point where they are identifiable to an item of work required under this contract.

(b) Such payment will be made only after receipt of paid or receipted invoices or invoices with canceled check showing title to the items in the prime contractor and including the value of materials and labor incorporated into the item. Petroleum products, including fuel, will be considered for payment as a material delivered offsite.

24 52.0-4330 EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE (MAR 1995)

EFARS 52.231-5000

(a) This statement shall become operative only for negotiated contracts where cost or pricing data is requested, and for modifications to sealed bid or negotiated contracts where cost or pricing data is requested. This clause does not apply to terminations. See 52.249-5000, Basis for Settlement of Proposals, and FAR Part 49.

(b) Allowable cost for construction and marine plant and equipment in sound workable condition owned or controlled and furnished by a contractor or subcontractor at any tier shall be based on actual cost data for each piece of equipment or groups of similar serial and series for which the Government can determine both ownership and operating costs from the contractor's accounting records. When both ownership and operating costs cannot be determined for any piece of equipment or groups of similar serial or series equipment from the contractor's accounting records, costs for that equipment shall be based upon the applicable provisions of EP 1110-1-8, "Construction Equipment Ownership and Operating Expense Schedule," Region III. Working conditions shall be considered to be average for determining equipment rates using the schedule unless specified otherwise by the contracting officer. For equipment not included in the schedule, rates for comparable pieces of equipment may be used or a rate may be developed using the formula provided in the schedule. For forward pricing, the schedule in effect at the time of negotiations shall apply.

For retrospective pricing, the schedule in effect at the time the work was performed shall apply.

(c) Equipment rental costs are allowable, subject to the provisions of FAR 31.105(d)(ii) and FAR 31.205-36. Rates for equipment rented from an organization under common control, lease-purchase arrangements, and sale-leaseback arrangements will be determined using the schedule, except that actual rates will be used for equipment leased from an organization under common control that has an established practice of leasing the same or similar equipment to unaffiliated lessees.

(d) When actual equipment costs are proposed and the total amount of the pricing action exceeds the small purchase threshold, the contracting officer shall request the contractor to submit either certified cost or pricing data, or partial/limited data, as appropriate. The data shall be submitted on Standard Form 1411, "Contract Pricing Proposal Cover Sheet."

## 25 52.0-4343 CONTRACTOR MAINTENANCE

At the end of each working day the Contractor shall police the work area and the area immediately surrounding the work area of all work-related debris. The Contractor shall comply with all applicable safety requirements and shall conduct his operations in a manner to insure an accident-free environment. Contractor shall keep all grassed areas within his work area in a neatly trimmed state during the growing season. Stacked materials shall not be within 25 feet of an active roadway.

## 26 52.0-4345 ASBESTOS - (Occupational Health and Environment)

(a) THE CONTRACTOR IS WARNED THAT EXPOSURE TO AIRBORNE ASBESTOS HAS BEEN ASSOCIATED WITH FOUR DISEASES: LUNG CANCER, CERTAIN GASTROINTESTINAL CANCERS, PLEURAL OR PERITONEAL MESOTHELIOMA AND ASBESTOSIS. Studies indicate there are significantly increased health dangers to persons exposed to asbestos who smoke, and further, to family members and other persons who become indirectly exposed as a result of the worker bringing asbestos contaminated work clothing home to be laundered or handled.

(b) The Contractor is advised that friable and/or nonfriable asbestos containing material has been identified in area(s) where contract work is to be performed and exists on or within materials and equipment to be removed during this project. Friable asbestos containing materials means any material that contains more than 1 percent asbestos by weight and possesses the quality that it may be crumbled, pulverized or be reduced to powder by hand pressure. Nonfriable asbestos containing materials are materials in which asbestos materials are bound by a matrix material, saturant, impregnant or coating. Nonfriable asbestos containing materials do not release airborne asbestos fibers during routine handling and end use. However, excessive fiber concentrations may be produced during uncontrolled abrading, sanding, drilling, cutting, machining, removal, demolition or other similar activities of nonfriable asbestos containing materials.

u

(c) Care shall be taken to avoid releasing or causing to be released asbestos fibers into the atmosphere where they may be inhaled or ingested. The occupational Safety and Health Administration (OSHA) has set standards in 29 CFR 1926.58 for occupational exposure to airborne concentrations of asbestos fibers in the construction industry. These standards define

permissible exposure limits, methods of compliance, personal protective equipment including clothing and respiratory protection, hygiene facilities and practices, establishment of regulated removal areas, employee information and training, exposure monitoring of airborne asbestos, signs and labels warning of asbestos hazards, housekeeping methods for fiber control and waste disposal, medical surveillance programs and recordkeeping of medical and exposure monitoring data. The environmental Protection Agency (EPA) has established standards in 40 CFR 61.140-156 (SUBPART M) for the control of asbestos emissions to the environment and the handling and disposal of asbestos waste. These standards define EPA notification that such removal is to take place. The required work practices and procedures include wetting, containment, container labeling, and disposal of removed materials in an approved sanitary landfill.

(d) When contract work activities are carried out in locations where the potential exists for exposure to airborne asbestos fibers as described in 1(b) or where asbestos waste will be generated, the Contractor shall ensure that all measures necessary to provide effective protection to persons from exposure to asbestos fibers and prevention of contamination to property, materials, supplies, equipment and the internal and external environment are effectively instituted.

(e) As a minimum the Contractor shall comply with the provisions of OSHA (29 CFR 1926.58), EPA (40 CFR 61.140-156), DoT (49 CFR 172.101; 172.200-205; 173.1090), and any state or local regulation applicable to safety and health, emission control and transportation and disposal requirements for asbestos.

(f) In addition to complying with the above regulations, the Contractor shall perform all asbestos removal and disposal operations in accordance with the requirements as set forth in SECTION:

(g) If the Contractor or any subcontractor identifies or encounters any suspect asbestos material (asbestos content greater than 1 percent by weight) not otherwise identified by the scope of work in the first clause during preconstruction, construction or post construction work activities in locations where contract work is to be performed, the Contractor shall immediately notify the Contracting Officer or COTR verbally with the followup in writing within 24 hours.

## 27 52.0-4370 EQUIPMENT LAYOUT DRAWINGS

The Contractor shall submit "layout drawings" in plan and necessary elevation, of all mechanical, electrical, heating, and ventilating equipment space(s) showing the proposed equipment, ductwork, piping, conduits, etc., with clearances, for approval of the Contracting Officer, whether or not such layout drawings are specified under the various technical sections of the specifications. In spaces having more than one type of equipment, the layout drawings shall indicate the composite arrangement of all types of equipment and all associated work with all clearances. The layouts of equipment and associated work shall provide adequate and acceptable clearances for entry, servicing, and maintenance. The submittal and approval of equipment layout drawings shall conform to the requirements as hereinbefore specified for shop drawings. Should the Contractor propose to furnish any equipment or standard products requiring allocations of space, or electrical, mechanical, or piping connections thereto, or supports different from those shown or indicated on the plans or in the specifications, he shall prepare and submit full detail drawings to the Contracting Officer for approval showing all changes. The approved

detailed drawings shall become a part of the contract and any changes in the construction resulting from revisions in the details and dimensions on the drawings which are required by the substitution of alternate equipment and/or products shall be made at the expense of the Contractor.

28 52.9999-4074 KEY PERSONNEL, SUBCONTRACTORS AND OUTSIDE ASSOCIATES OR

CONSULTANTS

Any key in-house personnel, subcontractors and outside associates or consultants required by the Contractor in connection with the services covered by the contract will be limited to individuals or firms that were specifically identified and agreed to during negotiations. The Contractor shall obtain the Contracting Officer's written consent before making any substitution for these designated key personnel, subcontractors, associates, or consultants.  
(End of clause)

29 52.9999-4072 CONTRACTOR PAYMENT REQUEST

A copy of CESAM Form 1151 entitled PROMPT PAYMENT CERTIFICATION AND SUPPORTING DATA FOR CONTRACTOR PROGRESS PAYMENT INVOICE is included hereinafter, with instructions, following the Wage Rates. This form will be used in conjunction with the CONTRACT CLAUSE entitled PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS. The contracting Officer will provide copies of the form to the Contractor upon request. The Contractor shall complete the form, sign the certification and submit it with each progress payment invoice.

30 52.0-4304 HVAC COMMISSIONING FUNCTIONAL PERFORMANCE TESTING

In the event of a failure of the functional performance testing phase of the commissioning process as defined in the technical specification SECTION: COMMISSIONING HVAC SYSTEMS, the Contractor will be assessed charges to acquire Government personnel back on site for retesting observation. These charges will consist of the Government personnel per diem expenses at the current Joint Travel Regulations (JTR) allowable rate, and the Government personnel travel expenses documented by invoice receipts submitted to the Contractor for air, rail, and automobile travel. Assessed charges to the contractor will also include a salary charge per man-day at the salary rate of a GS-12, step 5, for each Government employee from the District Office. The charges will be made for each additional functional performance testing phase required. Such costs will be deducted from the total amount due the Contractor.

31 52.0-4305 ENVIRONMENTAL RELEASE

An environmental release report shall be completed for all environmental releases which are caused by an Air Force activity or which occurs on an Air Force installation or facility.

Examples of environmental releases are listed as follows but are limited to: oil releases to navigable waters, hazardous substance release above the reportable quantity, vinyl chloride releases, excessive emissions over amount allowed in permits, hazardous material incidents occurring during transportation, underground storage tank spills and releases, and any emergency incidents of environmental contamination. The Contractor shall immediately notify the Contracting Officer's representative in the event of any environmental release. The following information shall be documented: the time, type, amount, and cause of the release.

### 32 52.0-4362 FORMAL CONTRACT - ORDER OF PRECEDENCE

- a. The formal contract between the Government and the successful offeror includes the standard contract clauses and schedules current at the time of solicitation issuance or modification by amendment. It also entails: (1) the solicitation in its entirety, including all drawings, cuts and illustrations, and any modifications during proposal evaluation or selection, and (2) the successful offeror's initial proposal and any subsequent revisions thereto, as accepted by the Government. The material contained in the formal contract constitutes and defines the entire agreement between the Contractor and the Government. No documentation shall be omitted which in any way bears upon the terms of that agreement.
- b. In the event of conflict or inconsistency between any of the provisions of the various portions of the solicitation, precedence shall be given in the following order:
  1. Any portions of the offeror's proposal which both meet and exceed the provisions of the "Request for Proposals" issued in connection with this contract (including all addenda, amendments, or other modification issued thereunder).
  2. The provisions of the "Request for Proposals".
  3. The contents of the offeror's proposal.
  4. If this contract requires the contractor to perform design work, the Government-reviewed, Contractor-prepared final plans and specifications.

### 33 52.227-7022 GOVERNMENT RIGHTS (UNLIMITED) (MAR 1979)

The Government shall have unlimited rights, in all drawings, designs, specifications, notes and other works developed in the performance of this contract, including the right to use same on any other Government design or construction without additional compensation to the Contractor. The Contractor hereby grants to the Government a paid-up license throughout the world to all such works to which he may assert or establish any claim under design patent or copyright laws. The Contractor for a period of three (3) years after completion of the project agrees to furnish the original or copies of all such works on the request of the Contracting Officer.  
(End of clause)

34 52.227-7024 NOTICE AND APPROVAL OF RESTRICTED DESIGNS (APR 1984)

In the performance of this contract, the Contractor shall, to the extent practicable, make maximum use of structures, machines, products, materials, construction methods, and equipment that are readily available through Government or competitive commercial channels, or through standard or proven production techniques, methods, and processes. Unless approved by the Contracting Officer, the Contractor shall not produce a design or specification that requires in this construction work the use of structures, products, materials, construction equipment, or processes that are known by the Contractor to be available only from a sole source. The Contractor shall promptly report any such design or specification to the Contracting Officer and give the reason why it is considered necessary to so restrict the design or specification.

(End of clause)

35 52.236-23 RESPONSIBILITY OF THE DESIGN-BUILD CONTRACTOR

(a) The Contractor shall be responsible for the professional quality, technical accuracy, and the coordination of all designs, drawings, specifications, and other services furnished by the Contractor under this contract. The Contractor shall, without additional compensation, correct or revise any errors or deficiencies in its designs, drawings, specifications, and other services.

(b) Neither the Government's review, approval or acceptance of, nor payment for, the services required under this contract shall be construed to operate as a waiver of any rights under this contract or of any cause of action arising out of the performance of this contract, and the Contractor shall be and remain liable to the Government in accordance with applicable law for all damages to the Government caused by the Contractor's negligent performance of any of the services furnished under this contract.

(c) The rights and remedies of the Government provided for under this contract are in addition to any other rights and remedies provided by law.

(d) If the Contractor is comprised of more than one legal entity, each such entity shall be jointly and severally liable hereunder.

(End of clause)

36 52.236-24 WORK OVERSIGHT IN DESIGN-BUILD CONTRACTS (APR 1984)

The extent and character of the work to be done by the Contractor shall be subject to the general oversight, supervision, direction, control, and

approval of the Contracting Officer.

(End of clause)

37 52.236-25 REQUIREMENTS FOR REGISTRATION OF DESIGNERS (APR 1984)

The design of architectural, structural, mechanical, electrical, civil, or other engineering features of the work shall be accomplished or reviewed and approved by architects or engineers registered to practice in the particular professional field involved in a State or possession of the United States, in Puerto Rico, or in the District of Columbia.

(End of clause)

(R 7-608.6 1972 APR)

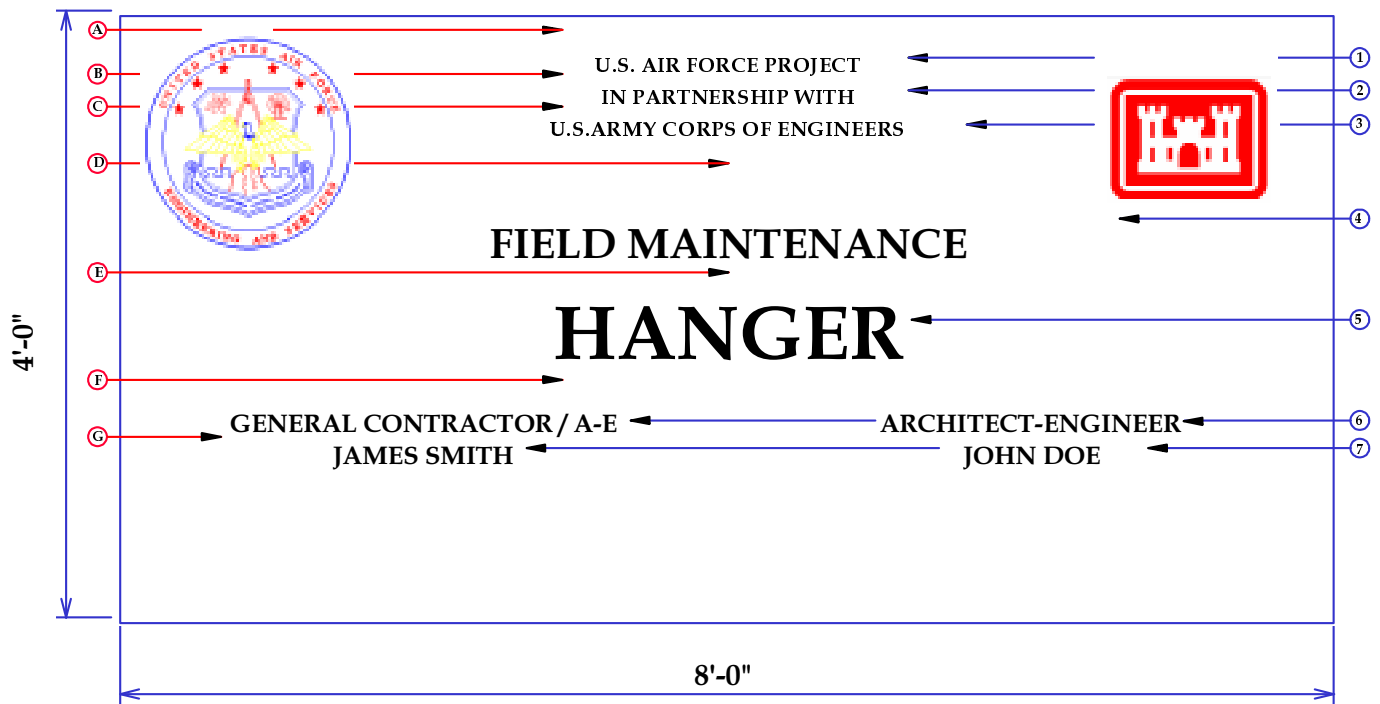
38 52.244-4 KEY PERSONNEL, SUBCONTRACTORS AND OUTSIDE ASSOCIATES  
AND CONSULTANTS (APR 1984)

Any key personnel, subcontractors and outside associates or consultants required by the Contractor in connection with the services covered by the contract will be limited to individuals or firms that were specifically identified and agreed to during negotiations. The Contractor shall obtain the Contracting Officer's written consent before making any substitution for these subcontractors, associates, or consultants.

(End of clause)

39 52.253-1 COMPUTER GENERATED FORMS (JAN 1991)  
(Reference 53.111)

END OF SECTION 00800



## SAMPLE CONSTRUCTION SIGN FOR MILCON PROJECTS

### SCHEDULE

SPACE	HEIGHT	LINE	DESCRIPTION	LETTER HEIGHT	STROKE
A	3"	1	U.S. AIR FORCE PROJECT	1.5"	3/16"
B	1"	2	IN PARTNERSHIP WITH	1.5"	3/16"
C	1"	3	U.S. ARMY CORPS OF ENGINEERS	1.5"	3/16"
D	5"	4	PROJECT NAME	4"	1/2"
E	3"	5	PROJECT NAME CONT'D (IF REQUIRED)	4"	1/2"
F	5"	6	GENERAL CONTRACTOR / A-E	1.5"	3/16"
G	1"	7	GENERAL CONTRACTOR / A-E	1.5"	3/16"

#### Colors (Fed. Std. 595a)

Background, Brown, semi-gloss - 20100 (1)  
 Lettering, white, gloss  
 Castle, red  
 AF emblem, colors as required (8" dia.)

#### Note:

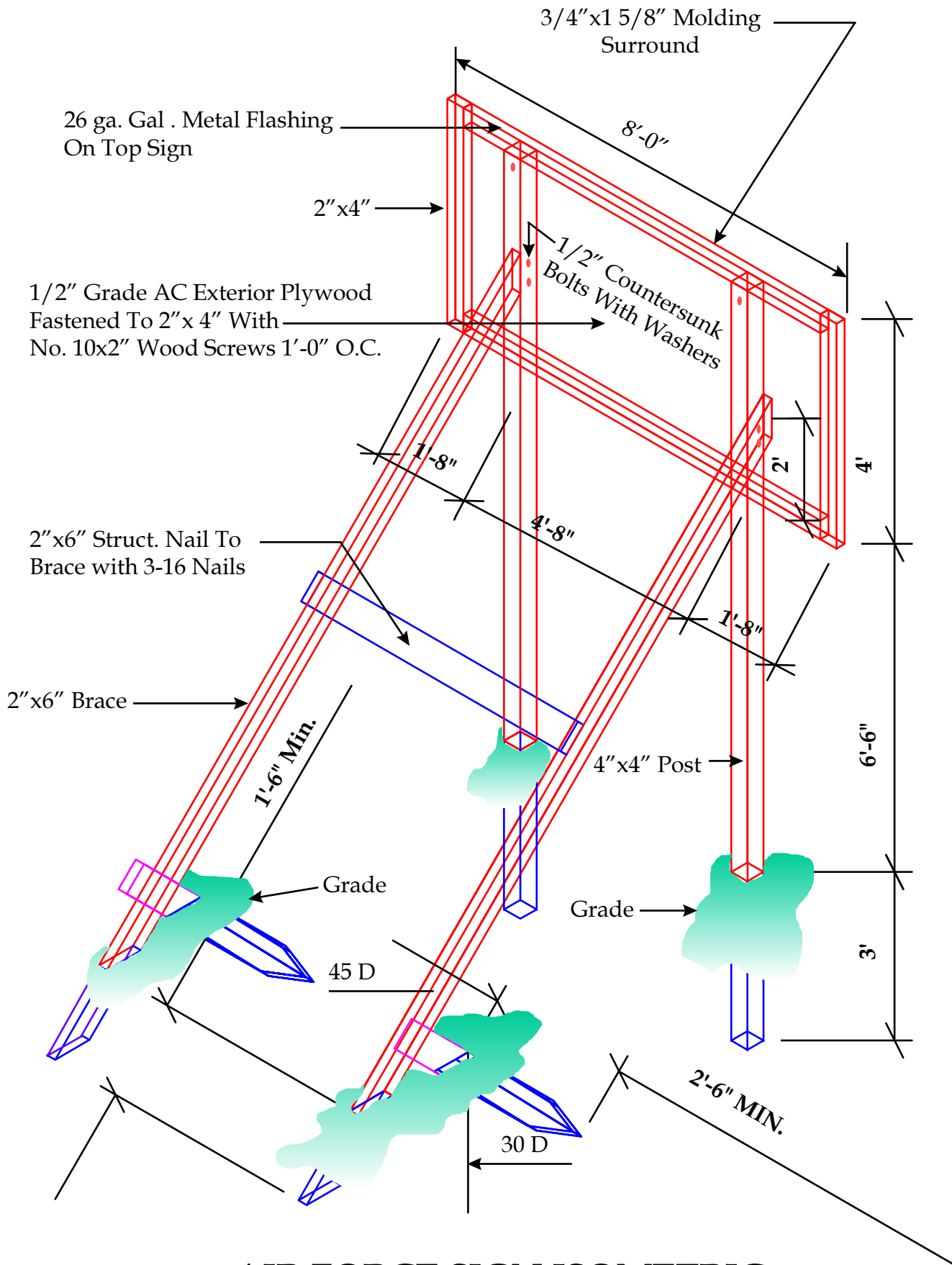
Use this sign at TAC Bases  
 (ie.) Tyndall, Macdill, Homestead,  
 Eglin, Hurlburt Field, Duke Field  
 and Howard AFB.

(1) Apply 1 coat primer followed  
 by 2 coats brown. Check with BCE to  
 verify 20100 correct color.

CONSTRUCTION SIGN  
 (A-E DESIGN)

Fig. 4c





AIR FORCE SIGN ISOMETRIC  
ERECTION DETAILS





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SECTION 01000

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SECTION 01000

ADDITIONAL SPECIAL CONTRACT REQUIREMENTS

1. CONTRACT DRAWINGS, MAPS AND SPECIFICATIONS

(a) One set of large scale (half-size optional) contract drawings will be furnished to the Contractor without charge. The Contractor will also be furnished (1) one set of reproducibles of the contract drawings, (2) 15 sets of specifications excluding applicable publications incorporated into the technical provisions by reference, and (3) 15 sets of half-size drawings. The work shall conform to the specifications and the contract drawings listed in the technical provisions.

(b) Omissions from the drawings or specifications or the misdescription of details of work which are manifestly necessary to carry out the intent of the drawings and specifications, or which are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work but they shall be performed as if fully and correctly set forth and described in the drawings and specifications.

(c) The Contractor shall check all drawings furnished him immediately upon their receipt and shall promptly notify the Contracting Officer of any discrepancies. Figures marked on drawings shall in general be followed in preference to scale measurements. Large scale drawings shall in general govern small scale drawings. The Contractor shall compare all drawings and verify the figures before laying out the work and will be responsible for any errors which might have been avoided thereby.

(SEE DRAWING SHEET NO. X-1 FOR INDEX OF DRAWINGS)

2. PHYSICAL DATA (APR 1984)

FAR 52.236-4

Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.

a. The indications of physical conditions on the drawings and in the specifications are the result of site investigations by surveys.

b. Weather Conditions. The location is subject to atmospheric temperature ranging from plus 7 degrees to plus 103 degrees Fahrenheit as determined from the U. S. Weather Bureau Station at Pensacola, Florida. The mean annual precipitation at Niceville, Florida is 58.85 inches and the mean monthly precipitation varies from a low of 3.12 inches in May to a high of 8.05 inches in July.

c. Transportation facilities.

(1) Railroads. The Burlington Northern Railroad serves Pensacola, Florida, the nearest railhead. The Contractor shall investigate the availability of sidings, and shall make all arrangements for use of any sidings for the delivery of any materials and equipment to be used on the work.

(2) Highways. Pensacola, Florida is served by U. S. Highways Nos. 29, 90, and 98. U. S. Highway No. 98 connects Pensacola and Fort Walton Beach, Florida, and runs along the mainland adjacent and parallel to Santa Rosa Island. Florida State Highway No. 85 connects Eglin Air Force Main Base with Fort Walton Beach, a distance of about 10 miles. The site of the work is accessible from Fort Walton Beach by bridge and paved road. The Contractor shall make his own investigation of available roads for transportation, load limits for bridges and roads, and other conditions affecting the transportation of materials and equipment to the site.

(3) Waterways. The Fort Walton Beach, FL. area is served by the Gulf Intracoastal Waterway. If the Contractor desires to use barge transportation for materials shipment, he shall make his own arrangements with commercial concerns for loading/off loading facilities. Government barge facilities at Eglin Air Force Base are not available for Contractor use.

### 3. TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER

1. This provision specifies the procedure for determination of time extensions for unusually severe weather in accordance with the contract clause entitled "Default: (Fixed Price Construction)". In order for the Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

a. The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.

b. The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the Contractor.

2. The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The Contractor's progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

#### MONTHLY ANTICIPATED ADVERSE WEATHER DELAY WORK DAYS BASED ON (5) DAY WORK WEEK

<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>MAY</u>	<u>JUN</u>	<u>JUL</u>	<u>AUG</u>	<u>SEP</u>	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>
5	5	5	3	3	5	8	6	5	3	4	5

3. Upon acknowledgement of the Notice to Proceed (NTP) and continuing throughout the contract, the Contractor will record on the daily CQC report, the occurrence of adverse weather and resultant impact to normally schedule work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the Contractor's scheduled work day.

The number of actual adverse weather delay days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse



weather delay days exceeds the number of days anticipated in paragraph 2, above, the Contracting Officer will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather work days, and issue a modification in accordance with the Contract Clause entitled "Default (Fixed Price Construction)".

4. AS-BUILT DRAWINGS:

The Contractor shall maintain two sets of full size drawings marked up by red line in an accurate, up-to-date as-built condition. Electrical and Mechanical conduit and pipe routing runs as well as all utilities will be shown, clearly identified and properly located on the As-Builts. All revised contract drawings issued by contract modification as well as all changes described by modifications for which new drawings are not issued will be included and/or noted on all affected drawings. Any deviations from details shown will also be noted. These as-built drawings will be subject to inspection by the Contracting Officer as frequently as necessary. The Contractor shall temporarily relinquish one set of these as-built drawings to the Contracting officer upon request, for the purpose of interim updates to original contract tracings. **Contractor shall complete all as-built drawings and furnish both sets to the Contracting Officer not later than 10 days after physical completion of the project.**

5. REGISTRATION OF PRIVATELY OWNED VEHICLES: All vehicles owned, leased, or operated on the reservation shall be registered at the Area Engineer Office. Evidence of required insurance must be presented at the time of registration. The Contractor, all subcontractors, and their employees shall remove Base decal from the vehicles upon termination of contract or employment and return to the Area Engineer office.

6. INTERRUPTION OF UTILITY SERVICES: Planned interruptions of utility services (electrical power, water, natural gas, etc.) shall be detailed and coordinated by the Contractor. Requests for interruptions which will involve base facilities other than in this contract shall be submitted in writing by the Contractor to the Contracting Officer at least 10 (ten) working days before the planned outage. If the outage affects only the facility in this contract, the request shall be submitted at least 3 (three) working days before the planned outage. Contractor shall not interrupt service(s) until approval has been granted. Requests shall include facility/facilities affected, date of scheduled outage, and duration. Requests for interruption of service(s) will not be approved until all equipment and materials required for that particular phase of work are on the job site. Interruptions will be granted Monday through Friday for the following times: 7:15 A.M. until 11:00 A.M. and 12:30 P.M. until 4:00 P.M. If weekend (Saturday and Sunday) outages are required or are preferred, they shall be coordinated as specified above.

7. CONSTRUCTION PERMITS: A local permitting procedure is in effect at Eglin AFB for any work which may disrupt aircraft or vehicular traffic flow, base utility services, routine activities of the installation or which may involve subsurface excavation. Contractor must plan and detail any work of this nature sufficiently in advance of the proposed work. An AF Form 103, Base Civil Engineering Work Clearance Request, must be submitted at least 10 (ten) working days in advance of the proposed performance date to the

Contracting Officer. Work will not begin until approval has been granted. Forms will be made available to the Contractor at the preconstruction conference.

8. HAZARD ANALYSIS PLAN: A hazard analysis plan, as described in Section 1, Article 01.A.05 of the Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, dated October 1992, is required for this contract.

SD-18 Records

Hazardous Analysis; GA; SO

9. RATES OF WAGES: Wage rates will follow.

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	Rates	Fringes
BRICKLAYERS/BLOCKLAYER	13.11	
CARPENTERS (Including Drywall Hanging, Batt Insulation, and Acoustical Ceiling Installation)	9.94	
CEMENT MASONS/CONCRETE FINISHERS	10.19	
ELECTRICIANS	9.97	.86
GLAZIERS	11.50	
INSULATORS, HEAT AND FROST	10.46	
LABORERS:		
UNSKILLED	6.84	
MASON TENDERS	7.00	.35
PAINTERS, BRUSH (Including Drywall Finishing)	10.23	
PLUMBERS	9.82	
POWER EQUIPMENT OPERATORS:		
BACKHOE	7.88	
GRADER	9.38	
ROLLER	6.75	
SHEET METAL WORKERS (Including HVAC Duct Work)	8.70	
TRUCK DRIVERS	6.50	

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29 CFR 5.5(a)(1)(v)).

In the listing above, the "SU" designation means that rates listed under that identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be

prevailing.

#### WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- \* an existing published wage determination
- \* a survey underlying a wage determination
- \* a Wage and Hour Division letter setting forth a position on a wage determination matter
- \* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations  
Wage and Hour Division  
U. S. Department of Labor  
200 Constitution Avenue, N. W.  
Washington, D. C. 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator  
U.S. Department of Labor  
200 Constitution Avenue, N. W.  
Washington, D. C. 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board  
U. S. Department of Labor  
200 Constitution Avenue, N. W.  
Washington, D. C. 20210

4.) All decisions by the Administrative Review Board are final.

END OF GENERAL DECISION

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## SECTION 01010

### DESIGN REQUIREMENTS

#### 1. PROJECT DESCRIPTION

The Contractor shall design and construct the Renovations to Dorm 19, Eglin AFB, Florida as shown on the criteria drawings and as specified herein. Design and construction shall result in complete and useable facilities.

The project site consists of one building with Sectors A, B, D and E. Each Sector consists of three floors. Sector D is included in Project, only if Alternate 1, 2, 3 or 4 is made a part of the Contract. At the junction of Sectors D and E is an existing laundry and storage area not included in this project. Demolition in Sectors A, B, and E, except as indicated on the drawing, will be competed as part of a separate contract. Demolition in Sector D shall be completed if one of the four Alternates is made a part of this contract.

Site layout and design and utility design shall be as shown in the criteria drawings and as specified in the construction specifications and the design requirements herein.

#### 2. DESIGN REQUIREMENTS

2.1 General: The Contractor shall prepare complete construction documents for all work designed under this contract. The construction documents to be prepared include but are not limited to construction drawings, submittals, and a design analysis. The preparation of these documents shall be as specified herein unless noted otherwise. Materials and equipment shall be limited to those specified herein except that where no specific material and equipment is specified, Contractor shall use materials and equipment accepted within the construction industry.

2.2 Intent: The intent of this specification section is to describe the requirements of equipment, materials, and methods of construction in sufficient detail to enable engineering and design to be performed.

2.3 Coordination between the various disciplines. The Contractor shall be responsible for the coordination between disciplines in order to fulfill the requirements of this contract and to provide for a complete, integrated and functional design.

2.4 Quality of work. Construction drawings shall be sufficient to afford a clear understanding of the construction work required. Work shall be organized in a manner that will assure thorough coordination between the various details on the drawings and between the drawings and the specifications. The Contractor shall cross-check all work until all conflicts have been reconciled.

2.5 Technical criteria. All designs and drawings shall be prepared as specified in this contract. All deviations from the technical criteria shall receive prior approval of the Contracting Officer. All questions or problems encountered by the Contractor in following criteria shall be promptly submitted with recommendations to the Contracting Officer for approval.

2.6 Conflicts in Criteria. Where the various elements of technical criteria are in conflict, the following priority shall be used to establish precedence:

1. Section 01010 Design Requirements
2. Criteria Drawings
3. Referenced Codes
4. Other referenced publications.

In cases where there are conflicts in referenced codes and publications, the more stringent criteria shall apply.

### 3. SITework DESIGN CRITERIA (DIVISION 2)

#### 3.1 Utilities

##### 3.1.1 Codes, Standards, Regulations and Recommended Practices

Unless otherwise specified or noted thereafter the analysis, design, detailing, and construction of all utility work, including site improvements shall conform to the following codes, standards, regulations and recommended practices. Latest edition at time of request for proposals shall govern.

ANSI - American National Standards Institute  
ASTM - American Society for Testing and Materials Standards  
AWWA - American Water Works Association  
National Fuel Gas Code  
National Standard Plumbing Code  
NFPA - National Fire Protection Association Codes  
SBCC - Standard Building Code  
UBC - Uniform Building Code  
Water Pollution Control Federation Manual of Practice

##### 3.1.2 General Requirements

3.1.2.1 Utility improvements will be designed and constructed in accordance with the criteria drawings, the utility details, and the technical construction specifications in these contract documents, and pertinent design criteria previously listed. The utility requirements of this project generally consist of domestic water service, fire protection water supply, sanitary sewer service, gas service, electrical power service, and telecommunications service.

3.1.2.2 Utility Location. The location of the utilities shown on the criteria drawings are approximate and final design layout shall be based on the actual location.

##### 3.1.3 General Design Criteria

The following general performance criteria shall be met as a minimum requirements in addition to all aspects of the design, construction and operations meeting the various respective codes.

3.1.3.1 Water Systems: Contractor to connect to the existing domestic water services as indicated on the drawings. For Sector 'D', the existing water distribution inside the building to be demolished.

3.1.3.2 Fire Protection Systems: Contractor to connect to the existing exterior water distribution system as shown.

3.1.3.3 Sanitary: Contractor to connect to the existing building sanitary sewer as indicated.

3.1.3.4 Chilled Water: Contractor to connect to the existing building supplies as indicated.

3.1.3.5 Natural Gas: Contractor to connect to the existing building supplies as indicated.

3.1.3.6 Storm Water: Provide new storm drain inlets and connect to existing services as indicated.

3.1.3.7 Power:

Telephone: Contractor to connect to the existing building trunk cable.

Cable: Contractor to re-use existing cable service entry.

### 3.2 Grading, Drainage and Paving

3.2.1 Grading, drainage and paving requires no design. Work shall be completed as indicated on the Drawing C-1 and as specified in Section 02210 and Section 02511.

### 3.3 Underground Sprinkler System

3.3.1 Underground sprinkler system requires no design. Work shall be completed as indicated on the Drawings L-3 and L-4 and as specified in Section 02811.

3.3.2 Attention is called to the requirement indicated on the Drawings that wells shall be drilled to supply sprinkler system.

3.3.3 Attention is called to the requirement indicated on the drawings that will remove parts of the sprinkler system if Alternate No. 1 is not made a part of the Contract.

### 3.4 Landscape Work

3.4.1 Landscape work requires no design work. Work shall be completed as indicated on Drawings L-1 and L-2 and as specified in Section 02935 and Section 02950.

## 4.0 ARCHITECTURAL WORK (DIVISION 5, 6, 7, 8, 9, 10, AND 12)

4.1 Architectural work shall be completed as indicated on Drawings A-1 thru A-30, A-46 thru A-60, and B-1; and as specified in Sections under Divisions 5, 6, 7, 8, 9, 10, and 12. Only design of details will be required.

### 4.2 Structural Interior Design

4.2.1 Definition: The Structural Interior Design (SID) shall involve the selection and sampling of all applied finishes necessary to complete the building's interior and exterior architectural features.

4.2.2 Design Requirements: The Contractor is to use Guide Specification 09915 Color Schedule for the development SID exterior and interior finishes. This is not optional.

## 5. FIRE PROTECTION AND LIFE SAFETY DESIGN CRITERIA

### 5.1 Codes, Standards, Regulations and Recommended Practices

Unless otherwise specified or noted hereinafter, the design, construction, and installation of all fire protection and life safety systems shall conform to the following codes, regulations, standards and recommended practices. Latest edition at time of invitation for bids shall govern.

NFPA - National Fire Protection Association Codes and Standards

UBC - Uniform Building Code

### 5.2 General Fire Protection and Life Safety Design Features

5.2.1 The Dormitory facility shall be fully protected by an automatic sprinkler system. All systems are to be designed in accordance with NFPA 13 and NFPA 13R.

5.2.2 The sprinkler systems shall be hydraulically designed by a registered fire protection engineer or a registered professional engineer with a fire protection background and who has at least four years experience in fire protection/detection design. Qualifications shall be submitted to and approved by the Contracting Officer. Contractor shall obtain water flow data for use with his hydraulic calculations. System to be designed to operate without the need for a building fire pump. Provide a minimum of one fire department connection for sector. Provide brass sign indicating type of connection.

5.2.3 Living quarters and associated kitchens, bathrooms and closets to be protected by a sprinkler system designed in accordance with NFPA 13R, for all other areas, sprinkler systems shall have a design in accordance with NFPA 13. Design densities for all except living quarters shall be:

Light Hazard	0.1 gpm/ft. sq.
Ordinary Hazard GR I	0.15 gpm/ft.sq.
Ordinary Hazard GR II	0.20 gpm/ft.sq.
Extra Hazard	0.35 gpm/ft.sq.

5.2.4 Separate Fire Protection/Life Safety floor plan drawings in accordance with NFPA 101 shall be submitted to the Contracting Officer for review. The Life Safety floor plan drawing shall include the life safety analysis, listing all the following provisions per UBC and NFPA 101:

1. Type of construction
2. Classification of occupancy
3. Building separation or exposure protection.
4. Fire protection criteria, codes, etc.
5. Location of all fire rated wall, fire partitions, fire-rated doors and dampers with their fire-resistive ratings.
6. Life safety provisions: exit travel distances, exit unit widths, occupant load and type, exit signs, and lighting, etc.
7. Automatic extinguishing systems - identify all sprinkled areas.
8. Water supplies.



9. Fire alarm systems - type, zones, and location of equipment.
10. Fire detection system - type, location of detectors, and zones.
11. Location of fire extinguisher cabinets.
12. Interior finish ratings.

5.2.5 The following type rooms shall be separated from the rest of the building by a minimum one hour fire rated walls and floors: all mechanical rooms, storage areas, and laundry rooms. All other areas shall have rated separations in accordance with NFPA 101.

5.2.6 Above ceiling: Exposed thermal insulation shall have a flame spread rating not greater than 25 or smoke developing rating greater than 50. All wiring installed in plenum shall be in metallic conduit or tubing.

Detail drawings shall conform to the requirements established for working plans as prescribed in NFPA 13 and NFPA 13R. The fire protection drawings shall delineate the following:

- The location and coverage of fire suppression system.
- The location of riser, fire department connection or any other major fire protection equipment.
- Indicate any hazardous areas and their classification.
- Prepare a schedule describing the system: occupancy classification, building construction type, design area, design density, hose stream requirements.
- The location of all fire walls.
- The hydrant test data with date performed.
- Provide details of the fire riser assembly and inspectors test station, etc.

5.2.7 All contract requirements that exceed the minimum requirements of NFPA 13 shall be incorporated into the design. Each floor of each wing shall be provided with flow switch, tamper switch and inspector's test. Provide number of zones per floor in accordance with NFPA.

5.2.8 Standpipes in open stairwells shall be provided with freeze protection to consist of heat trace and insulation. Insulation shall be provided with aluminum jacket.

5.2.9 Sprinkler systems will be supervised for water flow. All water gongs shall be mechanical. These supervisory signals will be monitored at a constantly attended location that would summon emergency response.

5.2.10 Walls and ceiling finishes shall conform to NFPA 101, Life Safety Code. Exposed insulation and acoustical materials applied to walls and ceilings will be considered an interior finish. Cellular plastics are not permitted for use as an interior finish. Use of Class C, D and E materials are not permitted. Interior finishes for exits and sleeping areas will be Class A only; all other areas will be Class A or B. Class A materials will not exceed a smoke-developed rating of 50. Class B material will not exceed a smoke-developed rating of 100. Classes of materials are defined in NFPA 101.

5.2.11 Halon fire extinguishing systems and portable extinguishers shall not be installed. Contractor shall provide cabinets or mounting brackets as required to meet governing codes. The fire extinguishers shall be Government furnished.

5.2.12 Fire alarm evacuation systems consist primarily of manual pull stations, room smoke detectors, and alarm indicating devices. Automatic alarm initiating devices such as detectors and water flow alarms shall be connected to these systems when provided. These systems shall be connected to a central alarm location, fire department or alarm monitoring location. Refer to electrical criteria for specific requirements for each building.

5.2.13 Dormitory room facilities shall be fully sprinkled with a wet pipe system in accordance with NFPA 13R. These facilities shall have fire detection and fire alarm evacuation systems. Quick response, residential-type sprinkler heads shall be used in all occupied living spaces. Quick response, commercial or industrial-type sprinkler heads are NOT acceptable as substitutes. Refer to electrical criteria for specific detection and alarm requirements.

5.2.14 Water supply to be obtained from the existing system. Provide double check detector assembly for backflow prevention.

## 6. PLUMBING DESIGN CRITERIA

### 6.1 Codes, Standards, Regulations and Recommended Practices

Unless otherwise specified or noted hereinafter, the design, construction, and installation of all plumbing systems shall conform to the following codes, regulations, standards and recommended practices. Latest edition at time of request for proposals shall govern.

ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. - Guide and Data Books
ASPE	American Society of Plumbing Engineers
NACPHCC-01	National Association of Plumbing-Heating-Cooling Contractors - National Standard Plumbing Code

### 6.2 Plumbing Design Features

6.2.1 The Contractor shall provide domestic hot water, domestic cold water, drain, waste and vent, natural gas piping and other services for equipment and facilities as noted on the drawings, as required for equipment listed in drawings and as required for complete and functional installation and as specified herein. Domestic cold and hot water piping shall be insulated as required by the applicable technical specification. Plumbing systems shall be designed to operate within existing available water pressures to be determined by the Contractor.

6.2.2 Plumbing plans shall be coordinated with the existing utilities. Extend from the existing water supplies and connect to existing sanitary facilities.

6.2.3 Plumbing access panels shall be provided where required for maintenance, repair, and removal of equipment, valves, and fixtures.

6.2.4 Water heaters or storage tanks shall be sized in accordance with the ASHRAE Guide. Provide gas fired water heating equipment at locations shown.

6.2.5 Where runs of domestic hot water line from water heater to furthest point of use exceed 50 feet, hot water recirculation pump(s) shall be provided. Time clock on hot water recirculation pump shall be provided to limit operations to periods of occupancy.

6.2.6 Check valves shall not be placed on cold water inlet of water heaters.

6.2.7 Hot water delivered to toilet facilities shall not exceed 110 degrees F to showers and 140 degrees F to clothes washing machines.

6.2.8 Fixtures and trim shall be in accordance with FS WW-P-541/GEN.

6.2.9 Faucets shall be provided with flow limiting devices for water conservation. Maximum allowable flow shall be 2 to 2-1/2 gpm.

6.2.10 All piping with the exception of individual fixture runouts shall be completely concealed in finished spaces. No piping shall be routed in floor slabs unless approved or directed by the Contracting Officer.

6.2.11 Flow velocities in water pipes shall not exceed 10 feet per second.

6.2.12 All piping shall be sloped to permit proper drainage and shall be properly supported with allowances for expansion and contraction.

6.2.13 All pipe runs shall insure space is provided for maintenance dedicated working clearance in accordance with the (NEC) National Electric Code. Piping shall not be routed over electrical equipment.

6.2.14 Floor drains shall be provided in all mechanical rooms. Trap primers shall be provided where floor drains are unused for long periods of time.

6.2.15 A floor-mounted receptor (mop sink) with 3-inch drain and removable strainer shall be provided in the janitors closets. Receptors shall be cast or molded stone, or enameled cast iron, with rim guard, approximately 20" x 28" with wall mounted service sink faucet.

6.2.16 All water piping subject to freezing shall be completely drainable and suitably protected.

6.2.17 Water supply piping shall not be buried under concrete floors except where noted, specified or allowed by the Contracting Officer.

6.2.18 Pipes passing under or through foundation walls shall be protected from breakage by means of a relieving arch or by an iron pipe sleeve two pipe sizes greater than the pipe passing through.

6.2.19 All hose bibcocks and wall hydrants shall be furnished with 1/2-inch water supply, vacuum breaker, and standard box type connection. A minimum of one wall hydrant shall be provided on each building exposure or as indicated on plans. All wall hydrants on exterior walls shall be frost proof type.

6.2.20 A minimum of 5 gpm shall be allowed for each bib faucet or wall hydrant.

6.2.21 Valves will be provided so that system maintenance can be performed without complete system shutdown. Valves shall be provided and shown on drawings for equipment isolation, sectionalizing, each branch, and riser for water systems.

6.2.22 The Contractor shall detail wall and roof penetrations on the drawings. Show or note aluminum jackets on pipe. Aluminum jacket shall be provided on all exterior pipe insulation and on all pipe insulation in heavy use areas.

6.2.23 Natural gas service shall be provided to each building sector. Service lines shall be sized to provide sufficient capacity to operate all gas fired equipment within the building. A pressure regulator and dirt leg with shut off valve shall be provided in the mechanical room of each building wing. Regulator shall be sized to provide required capacity while reducing pressure from service pressure to the water column pressure required by the equipment within the building. Building piping shall be electrically isolated from the distribution piping by a dielectric fitting. All gas piping shall be designed in accordance with NFPA 54 - National Fuel Gas Code. All underground metallic piping shall be provided with cathodic protection.

## 7. HEATING, VENTILATING AND AIR CONDITIONING (HVAC) DESIGN CRITERIA:

### 7.1 Codes, Standards, Regulations and Recommended Practices

Unless otherwise specified or noted hereinafter, the design, construction and installation of all HVAC systems shall conform to the following codes, regulations, standards and recommended practices. Latest edition at time of request for proposals shall govern.

AABC - Associated Air Balance Council Standards  
AMCA - Air Movement and Control Association Ratings  
ANSI - American National Standards Institute Standards  
ARI - Air Conditioning and Refrigeration Institute  
ASHRAE Guide and Data Books  
ASME - American Society of Mechanical Engineers  
ANSI/ASME 90A - "Energy Conservation in New Building Design"  
ASHRAE 62 - "Ventilation for Acceptable Indoor Air Quality"  
Carrier System Design Manuals  
NEBB - National Environmental Balancing Bureau  
NEC - National Electrical Code  
NEMA - National Electrical Manufacturer's Association  
NFPA Codes and Standards  
SMACNA - Sheet Metal and Air Conditioning Contractor's National Association  
UBC - Uniform Building Code  
UL - Underwriter's Laboratories

### 7.2 General HVAC Design Features

The HVAC systems shall be designed to the latest editions of the codes, standards and standard practices listed above, and to the specifications and drawings included in this package. Installation of all systems shall conform to the approved design. The highest quality products and materials, safe and

efficient construction methods, and skilled workmen shall be used to construct the approved HVAC systems. The Contractor shall be responsible for the professional quality and technical accuracy of the HVAC design documents and shall insure construction of the systems meets all requirements of the approved design. Drawings, specifications, and other design documents upon which construction is based shall be coordinated with other disciplines to insure compatibility of all building systems. Fiberglass ductwork shall not be used. Provide for complete HVAC design of Sectors A, B, c, and D as part of base bid.

7.2.1 Design Conditions:

Outside:	Summer	91 degrees FDB	81 Degrees FWB
	Winter	29 degrees FDB	

For make-up air unit: Summer 95 degrees FDB; 81 degrees FWB

Inside:	Summer	78 degrees FDB	50% RH
	Winter	68 degrees FDB	

7.2.2 Seismic Design:

Zone 0. No seismic considerations are needed for this project.

7.2.3 Sound and Vibration:

1991 Edition ASHRAE Handbook, HVAC Applications, Chapter 42.

7.2.4 Outside Air Criteria:

As indicated on the drawings for living/sleeping areas. Design to comply with ASHRAE 62-89 for all other areas.

7.2.5 Equipment Heat Loads:

Living/Sleeping Areas	500 Btuh per room
Offices	500 Btuh per occupant (desk) per room

7.2.6 The living/sleeping area of the dormitory building shall be heated and cooled by using apartment style two-pipe fan coil units. Fan coil unit controls shall be as indicated on the drawings. Supply air ductwork to be internally lined galvanized sheetmetal. All supply, exhaust and return air distribution devices shall be sized for a room NC of 30 or less. The living/sleeping area to be pressurized from a central make-up air system and exhausted to a central exhaust system. Fan coil unit front cover to be removable to allow service access to all valves, motors, filters and any other item requiring routine service. Dual temperature coils shall not be equipped with control valves. Each kitchen to be equipped with a recirculating-type residential kitchen hood, finish to match room interior design.

7.2.7 Make-up air system to be comprised of a horizontal draw through air handling unit with angled filter, dual temperature coil, hot water reheat coil, stainless steel drain pan, insulated dual metal wall construction and fan section. Provide hot water for reheat from domestic hot water system. Exhaust system to be comprised of a air-to-air heat exchanger and roof mounted

exhaust fan. Provide filter on each side (exhaust air and make-up air) of heat exchanger. Make-up air handling unit to be provided with normally closed outside air damper and freezestat. Exhaust fan to be interlocked with make-up air handling units.

7.2.8 Building heating and air conditioning system to be of the 2-pipe design. Chilled water to be obtained by connecting to the existing 3" chilled water services as shown. Heating plant to be comprised of new gas-fired boilers. Provide new dual temperature pump sized to circulate through the building dual temperature piping.

7.2.9 Controls for fan coil units to be electric type. Sleeping/living area fan coil unit controls to be as indicated. Controls for make-up air systems and dual temperature systems to be direct digital type compatible to Barber Coleman System 8000. Provide stand-alone DDC controller at each make-up air unit and boiler/2-pipe change over room. All DDC controllers to be connected to a single network controller which shall provide communication to existing zone EMCS (Barber Coleman Network 8000). Provide all modems, phone wiring and software required. Provide modem with 9600 baud compatibility. System to allow access to entire building EMCS from any controller location. Software to have User selectable security levels. Provide complete copy of engineering software which will provide the data communications to the existing Barber Coleman Network 8000. Service personnel shall be factory authorized and trained for Barber Coleman Network 8000. Control system repairs shall be completed within 24 hours of notification, and service organization shall be available 24 hours a day, seven days per week.

7.2.10 Piping systems shall be designed to include pipe, fittings, insulation, thermometers, gages, pumps, hangers, valves, flexible connectors, balancing cocks, wells for controllers and sensors, strainers, etc. as required to provide complete, functional, easy to balance systems. Piping in areas subject to freezing temperatures shall be heated to prevent freezing. Exterior chilled and hot water distribution systems under building floor slabs shall be preinsulated and jacketed. Chilled and hot water distribution piping under floor slabs shall be limited to that absolutely necessary. Piping systems on roof to be heat traced and provided with aluminum jacket.

7.2.11 The design shall include testing, balancing and adjusting of all HVAC systems by a certified test and balance firm. Reports of all tests shall be submitted for approval by the Contracting Officer on standard AABC or NEBB forms.

7.2.12 Complete Operations and Maintenance Manuals for all components of the HVAC systems shall be required by the design. Manuals shall be submitted for approval 60 days prior to the scheduled completion date for the project. The design shall include requirements for a minimum of ten working days to train operating personnel in the operation and maintenance of the complete HVAC system. Framed instructions, control drawings, and system diagrams shall be in place prior to the start of training.

7.2.13 Contractor to provide for warranty service as specified elsewhere in the RFP. During warranty period, contractor to provide 24-hour availability.

## 8. ELECTRICAL DESIGN CRITERIA:

### 8.1 CODES, STANDARDS, REGULATIONS, AND RECOMMENDED PRACTICES

Unless otherwise specified or noted hereinafter, the design, construction and installation of all electrical system shall conform to the following codes, regulations, standards and recommended practices. Latest edition at time of request for proposals shall govern.

ANSI	American National Standards Institute Standards
IES	Illuminating Engineering Society Lighting Handbook
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association Codes and Standards
UL	Underwriter's Laboratories
UBC	Uniform Building Code

### 8.2 GENERAL ELECTRICAL DESIGN FEATURES

#### 8.2.1 General Design Requirements

The electrical systems shall be designed to the latest industry standards, codes, government regulations, and to the specifications included in this package. Installation of all systems shall conform to the approved design. The highest quality products and materials, safe and efficient construction methods, and skilled workmen shall be used to construct the approved electrical systems. The Contractor shall be responsible for the professional quality and technical accuracy of the electrical design documents and shall insure construction of the systems meets all requirements of the approved design. Drawings, specifications, and other design documents upon which construction is based shall be coordinated with other disciplines to insure compatibility of all building systems. Quality, flexible lighting and electrical distribution system stems in the work areas is a primary requirement for the design of the electrical systems. The lighting and power distribution systems shall be designed to provide maximum flexibility for rearranging administrative office space without requiring relocation of lighting fixtures or the addition of power outlets.

#### 8.2.2 Design Drawing Requirements

Each building shall have a complete set of electrical design drawings. As a minimum, the following drawings are required:

- A. Lighting plans showing the layout, fixture type, switching arrangement, and power circuiting for all lighting equipment.
- B. Power plans showing the location and power connections for all branch circuits other than the lighting circuits shown on lighting plans, the location of all panels and switchboards, telephone outlet locations, fire alarm and detection equipment locations, cable television equipment and outlet locations, lightning protection system and grounding system connections.
- C. Detail sheets showing grounding system details and other construction details as appropriate.

- D. Schedule sheets containing panel schedules, lighting fixture schedule, switchboard schedule, and other schedules as appropriate.
- E. Riser diagrams, either on a separate sheet or combined with other sheets, consisting of Riser Diagrams for the Power Systems, Fire Alarm Systems, Cable Television System and Telephone Systems.
- F. Legend and General Notes, either as a separate sheet or combined with other sheets.

#### 8.2.3 General Interior/Exterior Electrical Distribution System Criteria

Each sector (or wing) of the existing dormitory building shall have only one electrical service entry. Primary system cabling from the existing utility poles shall be re-used. Existing load break elbows shall be re-worked and shall be replaced if necessary. The new pad-mounted transformers for the complex shall be installed in the same location as the old service (pad-mounted transformers) transformers.

Subpanels shall be located as required to adequately serve all lighting and power branch circuits. Surge protection shall be provided at all service entry points (See Specifications). Interior electrical distribution systems shall be designed to allow for a future load growth of 20%, with a minimum of 20% spare breakers in all panels and all feeder wiring and panels sized for such growth. Surface mounted panels and equipment shall only be installed in electrical rooms and mechanical spaces. All panels installed in normally occupied spaces shall be flush mounted. All branch circuits shall include a separate equipment ground wire regardless of the type of conduit used. All 125 volt general convenience receptacles utilized in dorm rooms, dayrooms, offices, storage areas, and outdoors shall be rated at 20 amperes (ground fault and weatherproof shall apply to all outdoor receptacles). All circuits shall be wired with a minimum of #12 wire in conduit and shall be 20 amperes. 20 Ampere circuits in excess of 100 feet shall be wired with #10 and shall comply with all voltage drop requirements as outlined in the National Electrical Code. In addition to equipment power in each building renovated, dedicated and convenience receptacles shall be provided as follows:

- A. Office Areas: Power shall be provided for a minimum of 2 computers, 2 laser printers, 1 fax machine, and a minimum of 4 general purpose convenience receptacles.
- B. Dormitory Areas: Power shall be provided as indicated on drawings.
- C. Storage Areas: Minimum of 1 general purpose convenience receptacle.
- D. Dayrooms/Lounge: One duplex receptacle shall be provided for every 15 linear feet of perimeter wall space. In addition a minimum of 2 dedicated duplex receptacles shall be installed on opposite sides of the dayroom areas for provisions for a television. Television set shall be provided and installed by the government.



- E. Mechanical/Electrical: Receptacles and power shall be installed as required for room purpose. A minimum of one (1) 20 ampere dedicated receptacle shall be installed in each mechanical and electrical room. Receptacles shall be installed on each auxiliary telephone and cable television backboard as indicated applicable details.
- F. Building Exterior: Ground fault and weatherproof receptacles shall be provided at every 3rd column bay on each building floor renovated. Additional receptacles shall be provided for all mechanical equipment per NEC. Receptacles shall also be provided for landscaping irrigation systems and other equipment as required.
- G. Laundry Rooms: Provide power connections to the laundry equipment in each building. Temporary power shall be provided to laundry room between wings D & E during the renovation construction phase. Power system shall be designed to support the entire laundry facility until renovation is completed, then the laundry shall be provided with permanent power.

#### 8.2.4 General Interior/Exterior Lighting System Design Criteria

Lighting in living/sleeping spaces shall utilize fluorescent residential-style fixtures and 35K fluorescent bulbs. All lights shall be controlled by wall switches. Provide separately switched light fixtures for each space within each living/sleeping area, to include closets.

Lighting in day room spaces shall be generally fluorescent. Provide emergency lighting in accordance with NFPA 101 for egress walkways on upper floors and stairwell areas within the building, and other areas as required by the NFPA.

Interior and exterior lighting system shall be designed for uniform lighting levels throughout each space. Lighting levels shall be designed to achieve the following lighting levels:

General Office Space	50 footcandles
Lounge/Day Rooms	15 footcandles
Mechanical/Electrical Rooms	15 footcandles
Toilets	20 footcandles
Living/Dorm Areas	40 footcandles
Corridors(outdoor)	10 footcandles
Volleyball Court (outdoors)	30 footcandles

Interior lighting shall generally be fluorescent type, utilizing energy efficient electronic ballasts and bulbs. Incandescent lighting shall not be used. All exterior lighting shall be HID type High Pressure Sodium. Lighting for the re-located volleyball court shall be HID type pole mounted luminaires. Locate poles and luminaires to comply with the latest IES recommendations. Exit signs installed throughout all buildings shall be Light Emitting Diode (LED) type. Egress lighting shall be provided in accordance with the requirements of NFPA 101.

#### 8.2.5 General Building Grounding System Design Criteria

Grounding systems for each building shall be designed and constructed in accordance with project criteria. The system shall be designed for a "high probability" of lightning discharge. A common grounding system can be utilized when practical for all grounding needs. When separate ground system

are provided, all grounding systems shall be tied together below grade, unless otherwise directed. The maximum grounding system resistance to earth in each building shall not exceed 10 ohms as tested under the conditions specified in the accompanying technical specifications.

A lightning protection system shall be provided and installed to comply with all applicable codes and standards. The system shall bear a listing agency's label and be certified as compliant with NFPA 780 and that agency's requirements. The lightning protection system shall be designed for a "high probability" strike area and shall be bonded to all other grounding systems (e.g. building main service, telephone system (base and local), cable television system, building steel, building service transformer counterpoise, etc.).

#### 8.2.5.1 Description of Analysis Work

The designer shall conduct measurements in a number of areas to determine the number and length of ground rods to provide the required ground resistance at each facility.

#### 8.2.5.2 Design of the Grounding Systems

The design documents shall completely reflect all of the design requirements. The design shall require field tests, in the construction phase, witnessed by the Contracting officer to determine the effectiveness of the grounding systems. All grounds for service entrances, lightning protection, and equipment grounds shall be tied together at each building.

### 9. ELECTRONIC AND SPECIAL SYSTEMS DESIGN CRITERIA

#### 9.1 CODES, STANDARDS, REGULATIONS AND RECOMMENDED PRACTICES

Unless otherwise specified or noted hereinafter, the design, construction and installation of all electrical systems shall conform to the following codes, regulations, standards and recommended practices. Latest edition at time of request for proposals shall govern.

NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association Codes and Standards
UL	Underwriter's Laboratories
UBC	Uniform Building Code

#### 9.2 GENERAL ELECTRICAL AND SPECIAL SYSTEMS DESIGN FEATURES

##### 9.2.1 General Design Requirements

The electrical systems shall be designed to the latest industry standards, codes, government regulations, and to the specifications included in this package. Installation of all systems shall conform to the approved design. The highest quality products and materials, safe and efficient construction methods, and skilled workmen shall be used to construct the approved electrical systems. The Contractor shall be responsible for the professional quality and technical accuracy of the electrical design documents and shall insure construction of the systems meets all requirements of the approved design. Drawings, specifications, and other design documents upon which

construction is based shall be coordinated with other disciplines to insure compatibility of all building systems.

#### 9.2.2 General Fire Alarm and Detection System Design Criteria

Each building shall have a separate fire alarm and detection system transponder panel which shall be tied into a central fire alarm control panel (FACP). The fire alarm system shall be centralized for the five building complex. The main Fire Alarm Control Panel (FACP) shall be located in Building C where the existing FACP is currently located. The entire complex shall be tied together via a digital communications network utilizing a #14 twisted pair. The FACP and all annunciators shall indicate via a liquid crystal displaying the device in alarms address an exact location within the building.

The system shall report to the Base Fire Department utilizing a Monaco Enterprises model BT2-5 radio transceiver installed adjacent to the main FACP is located. All buildings shall utilize vibrating horns and high visibility strobe lights for general evacuation alarms. Manual double-action pull stations shall be provided at all building exits and as required by NFPA 101. Duct smoke detection shall be provided as required by NFPA 90A and installed in accordance with NFPA 72. Post Indicator Valves and flow tamper switches serving each facility shall be electrically supervised by the respective Fire Alarm Transponder Panel. Fire Alarm Control Panels shall be located inside of electrical rooms with exterior access by authorized personnel only. A remote annunciator shall be installed in a mechanical room of the base fire department's choice of each building in the complex. At each annunciator a diagram showing the location and the address of each device in the system.

Heat detectors, manual pull stations, duct smoke detectors, audio-visual and visual devices connected to the central fire alarm system shall be installed in the following areas:

- A. Office Areas: Heat detectors, manual pull stations and audio-visual devices shall be installed per manufacturers recommendations and per code in all office areas (a minimum of 1 heat detector). Audio-visual devices shall be installed to comply with all applicable codes regarding notification (audibility and visibility). Pull stations shall be installed at all exits.
- B. Dormitory Areas: Heat detectors shall be installed as indicated on criteria drawings and in accordance with the manufacturers recommendations and NFPA.
- C. Storage Areas: A minimum of 1 heat detector shall be installed in all storage areas. Heat detectors shall be installed per manufacturers recommendations in all storage areas.
- D. Dayrooms/Lounge: Heat detectors and audio-visual devices, and manual pull stations shall be installed per manufacturers recommendations and per code in all dayroom and lounge areas (a minimum of 1 heat detector). Audio-visual devices shall be installed to comply with all applicable codes regarding notification (audibility and visibility).

- E. Mechanical/Electrical: Heat detectors, duct smoke detectors, pull stations, and audio-visual devices shall be installed per manufacturers recommendations and per code in all mechanical and electrical areas (a minimum of 1 heat detector). Audio-visual devices shall be installed to comply with all applicable codes regarding notification (audibility and visibility).
- F. Building Exterior: Manual pull stations shall be installed at all stair towers including those on the first floor. Audio-visual devices shall be installed to comply with all applicable codes regarding notification (audibility and visibility).

In addition to the central station fire alarm system all living/sleeping rooms shall have 120 volt stand alone single station automatic smoke detectors installed. Detectors shall provide only local alarm/annunciation upon activation by smoke.

### 9.2.3 Communications Systems

The communication components to be provided and installed under this contract are shown on the RFP drawings and indicated in the accompanying design criteria and specifications. The communications system includes a complete voice communication system consisting of copper wire transmission lines consisting of trunk riser lines and individual station cables and all associated backboards, distribution blocks, terminations, hardware, testing, equipment and materials necessary to provide a complete and functional system.

The entire telephone system shall be designed with 10% spare capacity for future expansion. A numbering scheme provided by the base communications group or approved by the base communication group shall be used. The contractor shall be responsible for making all terminations of station cables, riser cables and main service entry cables necessary for complete and working system. Trunk riser lines shall be designed provided along with all station cabling. Station cabling shall be 24 gauge 4 pair telecommunications cabling. Duplex type RJ11 receptacles shall be supplied in all key areas as follows:

- A. Office Areas: Telecommunications outlets shall be provided for a minimum of 2 computers, 1 fax machine, and 2 general purpose telephones.
- B. Dormitory Areas: One (1) Telecommunications outlet shall be provided for each dormitory room.
- C. Storage Areas: Not Applicable.
- D. Dayrooms/Lounge: A minimum of one(1) duplex telecommunications outlets shall be provided in each dayroom area.

- E. Mechanical/Electrical: Not Applicable.
- F. Building Exterior: Not Applicable.
- G. Special Provisions: Telecommunications connections shall be provided and connected at each electrical metering point.

#### 9.2.4 Cable Television Systems

All living/sleeping and office areas shall be equipped with cable television outlets. The system shall be cable in conduit from the CATV backboards/amplifiers to each living area and office area. Amplifiers, splitters, etc., shall be provided and installed for a complete and operational system. The existing cable television service entries may be re-used at the Contractor's discretion. Coordinate cable television service with the local cable television provider. Cable Television outlets shall be installed in the following locations:

- A. Office Areas: A minimum of 1 cable television outlet shall be installed in each office area.
- B. Dormitory Areas: One (1) cable television outlet shall be provided for each dormitory room.
- C. Storage Areas: Not Applicable.
- D. Dayrooms/Lounge: A minimum of one (1) cable television outlets shall be provided in each dayroom area.
- E. Mechanical/Electrical: Not Applicable.
- F. Building Exterior: Not Applicable.

-- END OF SECTION --

**SECTION 01012**  
**DESIGN AFTER AWARD**

1. DESIGN RESPONSIBILITY: The Contractor shall furnish and be responsible for a complete set of design documents as called for in Section 01010, Design Requirements, and as called for hereinafter.

2. DESIGN SUBMITTAL:

The Contractor shall submit his design at different stages of design to the Government for review. The number and requirements of each design submittal are listed hereinafter. The number and contents of the design submittals shall be reflected in the Contractor's progress charts. No construction work shall be performed by the Contractor until final design has been reviewed and approved for construction by the government. All comments for each submittal shall have been incorporated into the design.

3. GOVERNMENT APPROVED SUBMITTALS: The approval of submittals by the Contracting Officer shall not be construed as a complete check, but will indicate only that the design is in conformance with the contract requirements. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor is responsible for the design and construction of all work.

4. DESIGN SCHEDULE:

Within 21 days after Notice to Proceed, the Contractor shall submit, for approval, a complete design schedule with all submittals and review times indicated by calendar dates. This schedules shall be updated monthly. No progress payments will be made without an approved schedule. Any additional changes which the Contractor may wish to make to number or composition of design submittals shall be made 30 days prior to the expected submittal date. The Contractor shall allow 21 days for the Government review period if submittal dates are met. If a scheduled design submittal date is not met without notifying the Contracting officer in writing one (1) week in advance, 28 days shall be allowed for the Government review period. If a submittal date is not going to be met, the Contractor shall notify the contracting officer, in writing, one (1) week prior to the scheduled submittal date. failure to do so will increase the Government review time by seven (7) days. See Paragraph: "REVIEW COMMENTS".

5. PROGRESS CHARTS:

The Contractor shall prepare and submit a progress chart to the Contracting Officer. The progress chart shall show, as a percentage of the total design price, the various items included in the contract and the order in which the Contractor proposes to carry on the work, with dates on which he will start the features of the work and the contemplated dates for completing same. Significant milestones such as review submittals shall be annotated. The Contractor shall assign sufficient technical, supervisory and administrative personnel to insure the prosecution of the work in accordance with the progress schedule. The Contractor shall correct the progress schedule at the end of each month and shall deliver three copies to the Contracting Officer. Inasmuch as monthly partial payments to the Contractor are based to a large extent on the progress schedule, the monthly corrections should be realistically made to the best ability of the Contractor.

6. STAGES AND CONTENTS OF DESIGN SUBMITTALS:

6.1 50% Submittal:

#### 6.1.1 Paving, Grading and Drainage

- a. Provide drawing incorporating work as indicated on RFP Drawings C-1.
- b. Revise drawing to reflect any approved changes.

#### 6.1.2 Underground Sprinkler System

- a. Provide drawings incorporating work as indicated on RFP Drawings L-3 and L-4.
- b. Provide Specifications Sections 02210, 02222, and 02511.
- c. Revise drawings and specifications to reflect any approved changes and/or changes required by an alternate that is made part of the Contract.

#### 6.1.3 Landscape Work

- a. Provide drawings incorporating work as indicated on RFP Drawings L-1 and L-2.
- b. Provide Specification Sections 02935 and 02950.
- c. Revise drawings to reflect any approved changes and/or changes required by an alternate that is made part of the Contract.

#### 6.1.4 Architectural Work

- a. Provide drawing incorporating work as indicated on RFP Drawings A-1 thru A-30, A-40 thru A-60, and B-1. Add references to detail drawings.
- b. Provide Specification Sections from Divisions 5, 6, 7, 8, 9, 10, and 12 of the RFP Documents.
- c. Revise drawings to reflect any approved changes and/or changes required by an alternate that is made part of the Contract.
- d. Provide detail drawings (Sections, Elevations, etc.) of Windows, Doors, Rails, walls, Partitions, Shelving and Cabinets, and Mail Boxes.

#### 6.1.5 Structural Interior Design

- a. Definition: The Structural Interior Design (SID) shall involve the selection and sampling of all applied finishes necessary to complete the building's interior and exterior architectural features.
- b. 50% Submittals: The Contractor shall submit three (3) complete sets of the initial SID package. The design philosophy shall be interpreted using the Guide Specification 09915 Color Schedule. Guide Specification 09915 Color Schedule is not optional. All SID proposals shall be reviewed for compliance by the Government. When a finish sample is approved, it shall not be changed or substituted during the installation of products by the Contractor. Installation of changed and/or substituted products by the contractor will be considered fraud. The Contractor shall revise the SID binders after each review and update the SID to satisfy review comments. Each submittal will follow this method of review until the Government approves the completed SID package.

c. Format: This information shall be submitted in 3" D-ring binders, 8-1/2" X 11" format in accordance with the U.S. Army Corps of Engineers Design Manual Chapter 1- Interior Design.

#### 6.1.6 Plumbing

a. List all references used in the design including Government design documents and industry standards.

b. Provide justification and briefs description of the types of plumbing fixtures, piping materials and equipment proposed for use.

c. Provide detailed calculations for the sizing of the following systems:

- Domestic cold water piping
- Domestic hot water piping
- Waste and Vent
- Hot water heating system
- Natural gas distribution

d. Provide pipe layouts and risers for each plumbing system listed above. Included equipment and fixture schedules with description, capacities, locations, connection sizes, and other information as required.

e. The design analysis, submitted for review shall be consist of the following.

1. Design Narrative
  - Applicable design assumptions,
  - Size methods chosen and why,
2. Design Calculations:
  - Hot water requirements and water heater sizing,
  - Water and sewer main sizing,
3. Drawings:
  - Pipe sizing within the building
  - Sizing and placement of water hammer arrestors
  - Placement of pipe anchors on hot water piping.
4. Catalog cuts:
  - Water heaters
  - Circulating pumps
  - Backflow preventers

f. Drawings shall be complete with legends, floor plans, schedules section, details and risers diagrams.

g. Prepare detail calculations for systems such as sizing of domestic hot water heater and piping; compressed air piping, compressors and receivers; natural gas piping.

h. Indicate locations and general arrangement of plumbing fixtures and major equipment.

i. Include plan and isometric riser diagrams of all areas including hot water, cold water, waste and vent piping. Piping layouts and risers should also include natural gas (and meter as required), compressed air systems, and other specialty systems as applicable.

j. Include equipment and fixture schedules with descriptions, capacities, locations, connection sizes and other information as required.



#### 6.1.7 Fire Suppression System

a. The fire protection engineers qualifications shall be submitted to and approved by the Contracting Officer certifying that the design engineer is a registered fire protection engineer or a registered professional engineer with a fire protection background and who has had at least four years experience in fire protection/detection design.

b. Certificates shall be furnished to certify that the sprinkler system designed for the buildings in this project complies with the material and fabrication requirements of this specification.

c. The design analysis shall consist the design narrative, design calculations, and drawings as specified in the Design Criteria such as the fire protection and life safety drawings.

d. Drawings shall not be smaller than the scale used for architectural floor plans. Drawings shall provide the information required by paragraph 1-9 of NFPA 13 and any additional requirements as stated in the Design Criteria. The drawings shall be submitted for review.

e. Drawings will detail method of attaching water proofing membranes to sleeves passing through walls or floors that are subject to a static head of water.

f. All fire wall, floor and fire partitions shall be detailed on drawings to maintain fire resistive integrity as tested per ASTM E 814.

g. Locate or detail the following items on the contract drawings as applicable:

1. Control valve locations
2. Areas where solder joints for copper pipe are acceptable
3. Required flagged pipe or mechanical grooved coupling connection locations and symbols.
4. Wall and floor pipe penetration locations and details.
5. Centrifugal fire pumps and associated piping details and locations; and provisions for disposal of water discharged during testing.
6. Pipe runs requiring freeze protection location and length to be protected.
7. Fire department connections and water flow indicators locations and symbols.
8. Mounting location for local water flow alarm facilities.
9. Point of interconnection between alarm signal circuit and source of power will be indicated on the appropriate riser diagram.

h. Fire protection will be 100% complete by the 50% project deadline.

#### 6.1.8 Heating, Ventilating and Air Conditioning (HVAC)

a. A 50% HVAC design review package shall be submitted by the Contractor to the Government for review and approval. The package shall include the following submittals.

1. Final energy analysis and calculated energy budget.
2. Design analysis including 50% design calculations.
3. Preliminary temperature control drawings and sequence of operation.
4. Preliminary EMCS design drawings and interface drawings showing connections to existing EMCS system.
5. HVAC system drawings for 50% design.

#### 6.1.9 Interior Electrical System

- a. Provide a description of the lighting systems(s) to be used for all areas, referencing calculations.
- b. Also include a tabulation showing the following:
  - Room name and number.
  - Lighting intensity for each room. (State the basis for selection such as I.E.S., etc.).
  - Identify the type of fixture by manufacturers catalog cut.
  - State the type of wiring system to be used, such as insulated conductors installed in rigid or intermediate metal conduit, insulated conductors installed in electrical metallic tubing.
  - Define any hazardous classified locations by class, division, and group as defined by the National Electrical Code. Indicate the types of equipment to be used in these areas. State the reasons for the area(s) being hazardous classified locations.
  - Provide a lightning risk analysis and describe the lightning protection system to be installed. This should also include the type of grounding system planned and shown.
  - Describe the basic characteristics of panelboards, switchboards, motor control centers, and other major pieces of electrical equipment being provided. Short circuit and voltage drop calculations showing these values at all equipment with protective devices included shall be provided. Indicate equipment interrupting ratings and short circuit withstand ratings based on these calculations.
  - Describe the electrical metering equipment to be provided.
  - Provide a statement that no duct or liquid piping shall pass over and/or through any electrical space and/or room as defined by the National Electrical Code Article 384.
- d. The power riser or one-line diagram shall be essentially complete except for finalization of conduit and wire sizes.
- e. Panelboards, switchboards, motor control centers, and all other utilization equipment shall be located on the floor plans. Schedules for applicable equipment shall be provided. The schedules shall include all pertinent information to fully describe the equipment. Elevations for free standing equipment shall be provided but need not be entirely finalized.

- f. Details of the layouts for electrical closets and rooms shall be shown.
- g. Receptacles and lighting layouts (with wiring completed) shall be shown for typical rooms. Typical rooms are those which appear more than one time (sizes are the same) or those of the same function with different sizes.
- h. Areas where nonlinear loads will be encountered shall be identified. In these areas the use of 75 degree C. (minimum) conductors is required. Branch circuits serving eight-wire systems furniture or groups of nonlinear loads shall be 3 #12, 1 #10 N., 1 #12 GND. and 1 #12 Isolated GND. Feeders serving panelboards with nonlinear loads shall have the neutral conductor ampacity based on at least 1.73 times the ampacity of the phase conductors. The neutral bus in the panelboards shall have the same criteria. The simplest way to accomplish the up sizing of the neutral conductor is to provide double ampacity neutrals or parallel conductors in sizes permitted by the National Electrical Code.
- i. A completed fixture schedule shall be included on the drawings.

#### 6.1.10 Exterior Electrical Distribution System

- a. In narrative, clearly describe the electrical distribution system and state the changes to be made to the existing system to accommodate this project. State any deficiencies to be corrected and provide a description of all new work being performed.
- b. State the electrical characteristics of the power supply from the service point to the main service equipment.
- c. Indicate the type, number, voltage rating and connections, and kVA rating of all transformers provided whether Contractor provided or Government furnished (existing).
- d. State the type of conductor to be used and provide a justification for its use.
- e. Include a statement describing the criteria used for the exterior design such as secondary voltage drop. Provide the short circuit current available at the site and state the source of this value.
- f. Describe energy conservation measures and/or techniques that are being incorporated into the design.
- g. All of the exterior electrical design drawings shall be completed with all conductors (underground) with all pertinent components details. Details shall include but not limited to electrical services, ductbanks, etc.
- h. All removals shall be shown on demolition plans.

#### 6.1.11 Electronic Systems

Electronic systems responsibilities include the following:

- a. Fire Detection and Alarm System
- b. Telephone System
- c. Lightning Protection Grounding Systems
- d. Cathodic Protection

Some detailed checks will be made. Complete and independent checking of the design shall be accomplished by the Contractor. The Contractor is fully

responsible for the design. The design shall be complete and accurate. It shall be thoroughly checked for errors and conflicts (both within and between disciplines). The electronic systems drawing information may be placed on the electrical drawings or on separate electronic systems drawings.

When site adapting standard working drawings or designs used at other locations, the data required shall be limited to only design changes and/or updating for conformance to current criteria.

The design analysis shall include all calculations required to support design decisions and estimates at this stage of design. The analysis shall include specific criteria furnished, conference minutes and cost analyses of all systems considered.

#### 6.1.12 Exterior Systems

a. Provide the name of the licensed corrosion engineer or NACE specialist. Provide the following for cathodic protection systems:

- Clearly define areas of structures or components in soil or water to be protected.
- Type system recommended, comparison of systems, cost estimates showing all equipment alternatives.
- Calculations on all systems that are considered showing all information and descriptions.

b. Exterior work to be shown on electrical site plan.

- Show repair work to lightning protection system. Provide a blueline drawing of all repairs required for a labeled system.

#### 6.2 95% SUBMITTAL

##### 6.2.1 Paving, Grading, and Drainage

a. Provide drawings and specifications revised to comply with comments resulting from 50% submittal; and 100% complete, ready for construction.

##### 6.2.2 Underground Sprinkler System

a. Provide drawings and specifications revised to comply with comments resulting from 50% submittal; and 100% complete, ready for construction.

##### 6.2.3 Landscape Work

a. Provide drawings and specifications revised to comply with comments resulting from 50% submittal; and 100% complete, ready for construction.

##### 6.2.4 Architectural Work

a. Provide drawings and specifications revised to comply with comments resulting from 50% submittal; and 100% complete, ready for construction.

b. Provide three (3) complete sets of the approved and final Structural Interior Design package.

#### 6.2.5 Plumbing

a. A 95% plumbing design review package shall be submitted by the Contractor for Government review to include the final design analysis, specifications, and drawings of the plumbing systems showing the completed designs.

#### 6.2.6 Heating, Ventilating and Air Conditioning (HVAC)

a. A 95% HVAC design review package shall be submitted by the Contractor for Government review to include the final design analysis, specifications, and drawings of the HVAC systems showing the completed designs.

#### 6.2.7 Interior Electrical Systems

a. Completed short circuit calculations for the entire electrical system shall also be provided. All equipment shall be identified by manufacturer's name and catalog number.

b. Complete voltage drop and lighting calculations shall also be provided. The voltage drop calculations shall use the same single line diagram as the short circuit calculations and shall show drops at the same locations as short circuit currents are shown. Lighting calculations (zonal cavity method for interior and point-to-point for exterior) shall be provided for all rooms and spaces and all exterior locations requiring illumination.

c. The design narrative shall be an updated version of the 50% submittal but shall reflect the design as submitted. The aforementioned calculations shall be included with the narrative. The calculations and coordination study shall have the seal of the registered engineer who performed the same affixed to the cover sheet.

d. All details shall be completed at this stage. Congested areas which cannot be clearly shown at the drawing scale, shall be shown by expanded scale drawings.

e. The drawings shall be thoroughly checked for discipline conflicts to insure that the proper electrical connections are provided for equipment of other disciplines and that there are no conflicts between the location of electrical equipment and equipment of other disciplines.

f. The drawings shall also be checked for intradiscipline conflicts.

#### 6.3 FINAL SUBMITTAL

Complete Drawings and Specifications with all comments incorporated.

#### 7. QUANTITY OF SUBMITTAL ITEMS:

General: The documents which the Contractor shall submit to the Government for each submittal are listed and generally described. All drawings for review submittals shall be half-size blue lines. At the Final submittal, the Contractor shall also submit one (1) full size set of blackline paper plot drawings and a copy on CADD in Auto CADD Release 12, one (1) original hard copy set of the specifications and a copy on floppy disks in WordPerfect. One set of the 100% design drawings submitted to the COE MDO shall be reproducibles and on CD ROM.

8. MAILING OF SUBMITTALS

All submittals to the Government during design shall be mailed using overnight mailing service. The addresses to where each copy shall be mailed are listed below. Each submittal shall have a transmittal letter accompanying it which indicates the date, design percentage, type of submittal, list of items submitted, transmittal number and point of contact with telephone number.

Addresses and submittal distribution:

- (1) AFMC  
AFMC CES/CECC (Bob Klein)  
4225 Logistics Avenue, Suite 7  
Wright-Patterson AFB, Ohio 45433-5746
- (2) BCE  
96 CEG/CECC (Tim Kirby)  
501 DeLeon Street, Suite 100  
Eglin AFB, FL 32542-5133
- (3) MDO  
CDR, Army Engineer District  
Mobile (Robert Schodlbauer), Room 3011  
Mobile, AL 36628-0001
- (4) CD-GA  
Gulf Coast Area Office (CESAM-CD-GA)  
U.S. Army, Corps of Engineer  
15 - 10th Avenue  
Shalimar, FL 32579

The following charts list the number of copies of design submittal requirements for this project:

	#	ITEM 50%	#	ITEM 95%	#	ITEM Final
AFMC	2	Design Ana.	2	Design Ana.		
	2	Drawings	2	Drawings	2	Drawings
	2	Annot. Comm.	2	Annot. Comm.	2	Annot. Comm.
BCE	10	Design Ana.	10	Design Ana.		
	10	Drawings	10	Drawings	10	Drawings
			10	Specs	10	Specs
	10	Annot. Comm.	10	Annot. Comm.	10	Annot. Comm.
	3	Permit Appl.	3	Permit Docum.		
	1	SID Color Bd.	1	SID Color Bd.	1	SID Color Bd.
COE CD-GA	5	Design Ana.	5	Design Ana.		
	5	Drawings	5	Drawings	5	Drawings
			5	Specs	5	Specs
	5	Annot. Comm.	5	Annot. Comm.	5	Annot. Comm.
			2	Permit Docum.		
COE MDO	3	Design Ana.	3	Design Ana.		
	3	Drawings	3	Drawings	3	Drawings
			3	Specs	3	Specs
	3	Annot. Comm.	3	Annot. Comm.	3	Annot. Comm.
	3	Permit Appl.	3	Permit Docum.		
	1	SID Color Bd.	1	SID Color Bd.	2	SID Color Bd.

#### 9. REVIEW COMMENTS

For each design review submittal, the Contractor will be furnished comments from the various design sections of the Mobile District and from other concerned agencies involved in the review process. The review will be for conformance with the technical requirements of the solicitation. The Government will take twenty-one (21) days to review and comment on each design submittal including the 95% submittal. If the Contractor disagrees technically with any comment or comments and does not intend to comply with the comment, he shall clearly outline, with ample justification, the reasons for noncompliance within five (5) days after receipt of these comments in order that the comment can be resolved. The disposition of all comments shall be furnished in writing with the next scheduled submittal. The Contractor is cautioned in that if he believes the action required by any comment exceeds the requirements of this contract, that he should take no action and notify the District in writing immediately.

Review conferences will be held for each design submittal at Eglin Air Force Base, Florida. The Contractor shall bring the personnel that developed the design submittal to the review conference. These conferences will take place the week after the twenty-one (21) day review period.

If a design submittal is over one (1) day late in accordance with the latest design schedule and the Contractor has not given the Contracting officer a one (1) week notice that the submittal will be late, the Government review period will be 28 days instead of 21 days. The review conference will be held the week after the 28 day review period.

#### 10. PAYMENT DURING DESIGN

Payments, as authorized by the Authorized Representative Contracting Officer (COR), will be made monthly for the amount and value of the work and services performed by the Contractor. This estimate will be verified by the Contracting Officer utilizing the progress charts or the CONTRACTOR-PREPARED NETWORK ANALYSIS SYSTEM submitted by the Contractor and independent analyses of progress. See Contract Clause entitled PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS for additional information.

#### 11. DESIGN ANALYSIS

Media and Format: The design analysis shall be presented on 8-1/2 inch by 11-inch paper except that larger sheets may be used when required for graphs or other special calculation forms. All sheets shall be reproducible form. The material may be typewritten, hand lettered, handwritten, or a combination thereof, provided it is legible. Side margins shall be 1-inch minimum to permit side binding and head to head printing. Bottom margins shall be 1-1/4-inches, with page numbers centered 1-inch from the bottom.

Organization: The several parts and sheets of the design analysis shall be given a sequential binding number and bound under a cover indicating the name of the facility and project number, if applicable. The title page shall carry the designation of the submittal being made. The complete design analysis presented for final review with the final drawings and specifications shall carry the designation "FINAL DESIGN ANALYSIS" on the title page.

Design Calculations: Design calculations are a part of the design analysis. When they are voluminous, they shall be bound separately from the narrative part of the design analysis. The design calculations shall be presented in a clean and legible form incorporating a title page and index for each volume. A table of contents, which shall be an index of the indices, shall be furnished when there is more than one volume. The source of loading conditions, supplementary sketches, graphs, formulae, and references shall be identified. Assumptions and conclusions shall be explained. Calculation sheets shall carry the names or initials of the computer and the checker and the dates of calculations and checking. No portion of the calculations shall be computed and checked by the same person.

Automatic Data Processing Systems (ADPS): When ADPS are used to perform design calculations, the design analysis shall include descriptions of the computer programs used and copies of the ADPS input data and output summaries. When the computer output is large, it may be divided into volumes at logical division points. Each set of computer printouts shall be preceded by an index and by a description of the computation performed. If several sets of computations are submitted, they shall be accompanied by a general table of contents in addition to the individual indices. Preparation of the descriptions which must accompany each set of ADPS printouts shall include the following:

- a. Explain the design method, including assumptions, theories, and formulae.
- b. Include applicable diagrams, adequately identified.
- c. State exactly the computation performed by the computer.
- d. Provide all necessary explanations of the computer printout format, symbols, and abbreviations.



- e. Use adequate and consistent notation.
- f. Provide sufficient information to permit manual checks of the results.

## 12. DRAWINGS

All drawings shall be prepared on Computer-Aided Design and Drafting (CADD) so that they are well-arranged and placed for ready reference and so that they present complete information. The Contractor shall prepare the drawings in such a manner that the Corps of Engineers could construct the facility without any additional assistance from the Contractor. Drawings shall be complete, unnecessary work such as duplicate views, notes and lettering, and repetition of details shall not be permitted. Standard details not applicable to the project shall not be shown, an unnecessary wasted space shall be minimized. Details of standard products or items which are adequately covered by specifications shall not be included on the drawings. Drawings shall be detailed such that conformance with the RFP can be checked and to the extent that shop drawings can be checked. Shop drawings shall not be used as design drawings. The Contractor shall use standard Corps of Engineers title blocks and borders on all drawings. File, drawing and specification numbers and CADD file names will be furnished to the Contractor for inclusion in the title blocks of the drawings.

Final Submittal Media. Final drawing submittal shall include drawing files and plots. Drawing files shall be furnished in Auto CADD Release 12 format. Plots shall be furnished on 30" by 42" sheets and shall contain standard borders, title blocks, index sheets and CADD file names as furnished by the Government. Additionally, provide one blackline paper plot of all design drawings.

The design documents shall consist of drawings on a 30" by 42" format.

The building drawings shall consist of 1/8" scale minimum floor plans. Elevations shall be drawn to a 1/8" scale and other visual information as required. Building wall sections shall be drawn at a minimum of 3/8" scale.

The site and exterior utility drawings shall use a minimum scale of 1" = 30' unless otherwise indicated. Additionally, the overall site plan for this project shall be on one drawing sheet.

## 13. SPECIFICATIONS

The Contractor shall submit marked-up and final specifications as required. The specifications may be any one of the major, well known master guide specification sources such as MASTERSPEC from the American Institute of Architects, SPECTEXT from Construction Specification Institute or Corps of Engineers Guide Specifications, etc. The specifications shall be edited for this project and shall be submitted in marked-up or redlined draft version at the 95% Review Submittal stage. If the design is based on a specific product, the specification shall consist of the important features of the product. The specification shall be detailed enough such that another product meeting the specification could be substituted and it would not adversely impact the project. After incorporation of comments, a final, design complete specification package shall be submitted. Submit one (1) original hard copy set of the specifications and a copy on floppy disks in WordPerfect. All marked-out or redlined text shall be deleted and all inserted text shall be typed.

#### 14. SUBMITTAL REGISTER

The Contractor shall develop submittal requirements required during construction as part of the design phase of the contract. This shall be done by the Contractor's Designer of Record by producing a Contractor Submittal Register during design. A submittal register shall be attached to each section of the specifications for the submittal requirements of that section. The Submittal Register shall be prepared on ENG Form 4288. The Contractor's Designer of Record shall be responsible for listing all required submittals necessary to insure the project requirements are complied with. The Register shall identify submittal items such as shop drawings, manufacturer's literature, certificates of compliance, material samples, guarantees, test results, etc. that the Contractor shall submit for review and/or approval action during the life of the construction contract. The Contractor shall place all the Submittal Register pages in an appendix of the final specifications. See Section: 01300 SUBMITTAL PROCEDURES for submittal definitions and procedures.

15. DESIGNER OF RECORD: The Contractor shall identify and have on his staff a Designer of record to develop submittal requirements during design and be responsible for each submittal identified in the Contractor Submittal Register. A Designer of Record may be responsible for more than one submittal. All areas of work shall be accounted for by a listed Designer of Record. Designer of Records shall approve all submittals they are responsible for prior to submittal to the Government.

-- END OF SECTION --

## SECTION 01013

### GENERAL CONSTRUCTION REQUIREMENTS

1. CONSTRUCTION AUTHORIZATION No construction work shall be performed by the Contractor until final design has been reviewed by the Government. Upon satisfactory review, the Government will give the Contractor a written authorization to proceed with construction.
2. CONTRACTOR RESPONSIBILITY The Contractor is responsible for the design and construction of all work. In order to ensure quality, the Contractor shall develop a Quality Control Plan in accordance with Section: 01440 CONTRACTOR QUALITY CONTROL. In order to allow the Government to monitor the Contractor's progress and review his work, the Contractor shall develop a submittal register as specified in Section: 01300 SUBMITTAL PROCEDURES and paragraph: Submittal Register of Section: DESIGN AFTER AWARD.
3. DESIGNER OF RECORD The Contractor shall identify and have on his staff a Designer of Record for each submittal identified in the Contractor Submittal Register. A Designer of Record may be responsible for more than one submittal. All areas of work shall be accounted for by a listed Designer of Record. Designer of Records shall approve all submittals they are responsible for prior to submittal to the Government.
4. Eglin Blvd. No traffic interruptions will be allowed on Eglin Blvd.
5. Factory Equipment tests All pieces of equipment that requires factory testing will be witnessed by the Contracting Officer representative(COR). The Contractor shall notify the COR prior to any tests.

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**SECTION 01100**

FOR INFORMATION ONLY  
SEE SPECIFICATION SECTIONS 02080 AND 02090 FOR CONTRACT  
REQUIREMENTS.

**Asbestos and Lead-Based Paint Survey  
Dormitory 19  
Eglin Air force Base, Florida  
November, 1995**

*Submitted To:* Department of the Army  
U.S. Army Engineer District, Mobile  
Mobile, Alabama

*Submitted By:* SunBelt Environmental Associates, Inc.  
P.O. Box 170087  
Birmingham, Alabama 35217

*Contract No.:* DACA01-94-D-67

*Order No.:* 0003

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William H. Weems, DrPH  
Certified Industrial Hygienist (#1842)  
Accredited Asbestos Inspector (#IN0995W0018, Alabama)

## Section 1 - Summary

### 1.0 Survey Summary

SunBelt Environmental Associates, Inc. was tasked by the Army Corps of Engineers on 26 June 95 to survey Dormitory 19 at Eglin Air Force Base, Florida to identify and make recommendations concerning asbestos-containing materials (ACM) and building components coated with lead-based paint (LBP) prior to renovation of the structure.

### 1.1 Asbestos-Containing Materials (ACM)

The onsite asbestos survey was conducted July 19-20 and September 14, 1995. Details and documentation of the asbestos survey are presented in Section 2-ACM. Materials in Dormitory 19 that were found to contain asbestos are summarized below:

Homogeneous Area: 02

Description : Exposed Floor Mastic  
~~—(See Photograph A-02)~~

Location : ~~Rooms A-227, A-327~~  
New Storage Rooms, D-Wing, Second Floor  
New Storage Rooms, D-Wing, Third Floor

ROOMS D218, D220, D221, D223, D314, D317, D318, D320, D321, D323, D324, D326

Quantity : ~~2468 S.F.~~ 1870 S.F.

Asbestos Content : 4 - 20% Chrysotile

Samples : ~~19-02-01, 19-02-02, 19-02-03,~~ 19-02-04, 19-02-05,  
19-02-06, 19-02-06Q

Condition : Poor (Non-Friable)

Recommendations : Removal

NOT IN CONTRACT

Homogeneous Area: 04

Description : TSI, Horizontal Hot Water Tank  
(See Photograph A-03)

Location : Boiler Room

Quantity : 1 each, 100 S.F.

Asbestos Content : 5 - 13% Chrysotile

Samples : 19-04-01, 19-04-02, 19-04-03

Condition : Good (Friable)

Recommendations : Removal Prior to Renovation

Homogeneous Area: 05

Description : TSI, Pipe Insulation (Canvas Jacket, 4" - 6" O.D.)  
(See Photograph A-05)

Location : Boiler Room D123

Quantity : ~~220 L.F.~~ 4 LF

Asbestos Content : 5 - 22% Chrysotile

Samples : 19-05-03, 19-05-04, 19-05-04Q

Condition : Fair (Friable)

Recommendations : Removal Prior to Renovation

NOT IN CONTRACT

Homogeneous Area: 06

~~\_\_\_\_\_ Description \_\_\_\_\_ : TSI, Boiler (2) & Flue Insulation  
\_\_\_\_\_ (See Photograph A-04)~~

~~\_\_\_\_\_ Location \_\_\_\_\_ : Boiler Room~~

~~\_\_\_\_\_ Quantity \_\_\_\_\_ : 1716 S.F.~~

~~\_\_\_\_\_ Asbestos Content \_\_\_\_\_ : 5 - 20% Chrysotile~~

~~\_\_\_\_\_ Samples \_\_\_\_\_ : 09-06-01, 19-06-02, 19-06-03~~

~~\_\_\_\_\_ Condition \_\_\_\_\_ : Fair (Friable)~~

~~\_\_\_\_\_ Recommendations : Removal Prior to Renovation~~

Homogeneous Area: 08

Description : Textured Ceiling  
~~\_\_\_\_\_ (See Photograph A-07)~~

Location : D & ~~E~~ Wings, All Quarters Rooms

Quantity : ~~28,250 S.F.~~ 13,359 S.F.

Asbestos Content : 2 - 3% Chrysotile

Samples : ~~19-08-01, 19-08-01P, 19-01-02, 19-01-03~~

Condition : Good (Friable)

Recommendations : Removal Prior to Renovation

Homogeneous Area: 09

Description : Linoleum (Backing)  
~~(See Photograph A-08)~~

Location : D & ~~E~~ Wings, All Bathrooms

Quantity : ~~4,200 S.F.~~ 2,211 S.F.

Asbestos Content : 10 - 90% Chrysotile

Samples : ~~09-09-01B, 19-09-01Q, 19-09-02B, 19-09-03B~~

Condition : Good (Non-Friable)

Recommendations : Removal Prior to Renovation

#### NOT IN CONTRACT

~~Homogeneous Area: 10, 16~~

~~Description : Roofing Tar  
(See Photograph A-01)~~

~~Location : Roof, A, B, D & E Wings~~

~~Quantity : 51,366 S.F.~~

~~Asbestos Content : 2 - 20% Chrysotile~~

~~Samples : 19-10-01, 19-10-02, 19-10-03, 19-10-03P,  
19-10-04, 19-10-05, 19-10-06, 19-10-07, 19-16-01,  
19-16-02, 19-16-03, 19-16-04, 19-16-05, 19-16-06,  
19-16-06Q, 19-16-07~~

~~Condition : Good (Non-Friable)~~

~~Recommendations : Removal Prior to Renovation~~



Homogeneous Area: 18

Description : TSI, Vertical Hot Water Storage Tanks

Location : Rooms ~~A-102, A-107, A-117, B-117, E-102, E-107,~~  
~~E-116, D110, D117~~

Quantity : ~~7 each, total 704 S.F.~~  
~~2 EACH; ONE 300 GALLON, ONE 500 GALLON~~

Asbestos Content : 4 - 16% Chrysotile

Samples : ~~19-18-01, 19-18-02, 19-18-03, 19-18-04~~

Condition : Fair (Friable)

Recommendations : Removal Prior to Renovation

#### NOT IN CONTRACT

~~Homogeneous Area: 19~~

~~Description : TSI, Exterior Flue  
(See Photograph A-06)~~

~~Location : Boiler Room (Outside)~~

~~Quantity : 226 S.F.~~

~~Asbestos Content : 8 - 11% Chrysotile, 2 - 3% Amosite~~

~~Samples : 19-19-01, 19-19-02, 19-19-03~~

~~Condition : Good (Friable)~~

~~Recommendations : Removal Prior to Renovation~~

## **1.2 Lead-Based Paint (LBP)**

The onsite lead-based paint survey was conducted on July 18-20 and August 7-8, 1995. Details and documentation of the lead-paint survey are presented in Section 3-LBP. The survey involved 378 XRF tests and 37 paint chip analyses. Results of the survey indicate that only the metal handrails in the stairwells are positive for LBP. A random paint chip sample (field #101, laboratory #534080) of the handrail indicated 0.84% lead concentration. This concentration exceeds the HUD threshold (0.5% by weight) for lead in paint.

The 15 Stairwells in Dormitory 19 contain a total of 720 L.F. of handrails. Handrail coatings are currently in fair to good condition. There is some chipping. Abatement by in-place chemical stripping of coatings or removal and replacement of intact handrails is recommended.

## **Section 2-ACM**

### **2.0 Asbestos Survey**

An asbestos survey of Dormitory 19 was conducted on July 19-20 and September 14, 1995. This onsite evaluation was performed by Dr. William Weems, a Certified Industrial Hygienist and an E.P.A. certified asbestos inspector. The initial task was to establish homogeneous areas of suspect building materials for subsequent sampling and analyses. Homogeneous areas describe building materials judged to be identical by color, texture, proximity, and date of installation. Nineteen (19) homogeneous areas were identified in Dormitory 19.

#### **2.1 Sampling and Analyses**

All sampling of suspect homogeneous areas was conducted in general accordance with the protocol established in E.P.A. Publication 560/5-85-024 (The Purple Book). Selection of sample locations for planar surfaces were determined from building drawings or field sketches of the subject area by using a transparent numbered-grid overlay and electronic random number generator. A stratified random sampling protocol was followed for testing of homogeneous areas common to all of the living quarters in either of the two buildings. This modified procedure was followed to avoid waking day sleepers who occupied a number of the units. A minimum of three (3) samples were collected for each homogeneous area. Five (5) samples were collected for homogeneous areas of 1000 square feet or greater and seven (7) samples for areas of 5000 square feet or greater. Sampling locations for non-planar surfaces were judged to be representative of the homogeneous area. An effort was made to take destructive bulk samples from places that were not generally visible, but only to the extent that random sampling protocol would not be violated.

Asbestos bulk samples were analyzed in accordance with E.P.A. Publication 600/M-4-020-82, "Interim Method for the Identification of Asbestos in Bulk Insulation." Under this procedure, percentages of fibrous and non-fibrous constituents are visually estimated using stereoscopic and polarized light microscopy coupled with dispersion staining. Analyses were performed by the University of Alabama's fully accredited Environmental Laboratory. Results are reported as ND (none detected), TR (trace, less than 1%), or as a percentage of asbestos by type of asbestos. A three-part sample numbering scheme was used in this asbestos survey. It consists of the building number, followed by the homogeneous area number, followed again by the specific sample number. Alphabetic suffixes (A, B, or C) denote separate analyses of the layers of a single sample of composite materials - usually separate analyses of floor tile and adhering mastic. The suffix "Q" denotes a quality control sample. Of the 74 regular samples, 10% (or 7 samples) were randomly selected for analysis by the University of Wisconsin for quality control purposes. The suffix "P" denotes a point-count sample. These analyses are conducted to provide quantitation of asbestos content in accordance with E.P.A. Test Method 600/R-93/116. Point-count methodology is used to verify that low content samples do, in fact, contain more than 1% asbestos. Roof tar and textured ceiling samples from Dormitory 19 were subjected to point-count analyses. These point-count analyses were performed by the University of Alabama. Sample numbers are plotted on building drawings (separately bound) to provide a record of sample locations.

## **2.2 Asbestos Survey Results**

Asbestos laboratory reports are presented in Appendix A. Ten (10) of the 19 homogeneous sampling areas in Dormitory 19 were positive for asbestos. These 10 areas are described in the Summary section. The nine (9) negative homogeneous areas are listed below:

1. Pipe joint insulation in the Mechanical Rooms
2. Corridor floor coating, D-Wing, 3rd Floor
3. Metal jacketed pipe insulation in the Boiler Room
4. Floor tile and mastic, 3rd Floor Corridor, D-Wing
5. Ceiling tile, 1st Floor, D-Wing
6. Ceiling tile, 3rd Floor, D-Wing
7. Linoleum, Baths, A & B Wings
8. Textured Ceilings, A & B Wings
9. Ceiling tile, 3rd Floor, B-Wing

## Section 3 - LBP

### 3.0 Lead Based Paint Survey

A survey to determine the presence of lead-based paint in Dormitory 19 was conducted on July 18-20 and August 7-8, 1995. This work was performed by John A. Sikes, SunBelt's Senior Environmental Hygienist.

### 3.1 XRF Testing

Following a walkthrough of the dormitory to identify painted components and areas by the inspector, the survey was performed using a SciTech Corporation MAP 3 portable X-ray fluorescence instrument in accordance with the contract specifications, HUD's *Interim Guidelines for Lead-based Paint Hazard Identification and Abatement* (September, 1990), and instrument manufacturer's instructions. In accordance with the HUD Interim Guidelines and the previously submitted Safety Plan, the XRF instrument was checked against calibration standards frequently. A log of calibration check tests is included in Appendix C of this report. Also, a total of 69 substrate correction tests were conducted to correct XRF test results for substrate bias. Including the substrate correction tests, 378 XRF tests were performed on various painted components located throughout Dormitory 19.

### 3.2 Component/Substrate Inventory

The painted component/substrate combinations included in the survey, with the substrate correction value for each, are as follows:

Component/Substrate	Substrate Correction Value
Gypsum ceilings and walls	0.28
Metal doors	0.14
Hardboard doors	-0.14
Metal door frames	-0.28
Concrete block walls	0.16
Concrete walls and ceilings	0.38
Concrete floors	0.21
Concrete walkway rails	0.38
Concrete columns	0.08
Metal AC units	-0.18
Metal exterior beams	-0.58
Insulated pipe	None*
Vinyl stair trim	None*
Chair rail	None*
Window sill	None*
Roof ladder*	None*

\*These components were encountered too infrequently to calculate a substrate correction value. However, the painted surface results for each were close to or less than zero.

### 3.3 Areas Tested

The following dormitory areas were identified and tested with the XRF instrument. Selection of areas was essentially random.

Dormitory rooms	Manager bathrooms
Dormitory bathrooms	Manager closets
Day rooms	Laundry rooms
Recreation rooms	Stairwells
Storage rooms	Exterior walkways
Mechanical rooms	Exterior walls
Manager offices	

The location of each XRF test is noted on the report drawings (separately bound).

### 3.4 Paint Chip Sampling

In addition, paint chip samples were collected for laboratory analysis in the following circumstances:

- (1) For resolution of inconclusive XRF results, if required;
- (2) From painted components that were not suitable for analysis with the portable XRF instrument. These included round metal handrails in stairwells and rough-textured ceilings found in dorm rooms and some other areas; and
- (3) For QA/QC requirements of the contract specifications.

18 QA/QC and 19 confirmation and/or determination samples (where XRF testing was inappropriate due to surface characteristics) were collected and analyzed. Sample collection methods followed those described in the HUD *Interim Guidelines*. All sample results are included in the enclosed laboratory results. In summary, the only positive result (greater than 0.5% by weight lead or greater than 1.0 mg/cm<sup>2</sup>) was for a metal handrail located in stairwells. All other laboratory test results for confirmation and/or determination samples were negative for lead.

### 3.5 Summary of Survey Findings

Areas containing lead include the following:

Location	Coverage	Condition	Concentration Pb
Stairwell	approximately	Fair to good	0.84% / 0.315 mg/cm <sup>2</sup> *

handrails (15 stairwells)	2,970 LF of rails	(some chipping)	(found in E Wing, 3rd floor)
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\* One out of seven handrails tested positive for lead. The laboratory results for the remaining stairwell handrails are as follows:

Location	Concentration Pb
D Wing, 1st floor	0.39 % / 0.178 mg/cm <sup>2</sup>
A Wing, 3rd floor	0.05 % / 0.033 mg/cm <sup>2</sup>
B Wing, 2nd floor	0.22 % / 0.158 mg/cm <sup>2</sup>
B Wing, 1st floor	0.45 % / 0.202 mg/cm <sup>2</sup>
A Wing, 2nd floor	0.41 % / 0.223 mg/cm <sup>2</sup>
B Wing, 2nd floor	0.16 % / 0.036 mg/cm <sup>2</sup>

### 3.6 Characterization of identified lead-based paint

The lone positive area of lead-based paint is located on handrails in the 3rd floor stairwell of E wing. Given the heavy use of hand rails, and the susceptibility to peeling, flaking, damage and its relatively exterior location, further damage and deterioration is likely. The chain of custody and laboratory reports are included. The sample number for this specific location is 101 (field) and 534080 (lab).

### 3.7 XRF Testing Report as per HUD Interim Guidelines

Results are summarized according to the ranges for low, inconclusive and positive for the SciTech MAP 3 spectrum analyzer portable XRF instrument. These ranges, published in the HUD *Interim Guidelines*, are as follows:

Low or no lead ..... < 0.8 mg/cm<sup>2</sup>  
 Inconclusive ..... 0.8 - 1.2 mg/cm<sup>2</sup>  
 Positive ..... > 1.2 mg/cm<sup>2</sup>

#### Interpretation as per HUD Interim Guidelines

The XRF Testing Report indicates that 304 components tested in the low or negative range for lead. All 4 inconclusive XRF readings and the lone positive XRF reading were confirmed by the laboratory to be below the 0.5% by weight lead threshold. Accordingly, no tested component requires abatement or further testing, according to the *HUD Interim Guidelines*.

Component/Substrate	<0.8	0.8-1.2	>1.2	Substrate correction	Confirmation Samples
Gypsum ceilings, walls	33	0	0	7	10
Hardboard doors	24	0	0	5	0
Metal doors	36	0	0	6	0
Metal door frames	58	0	0	10	0
Concrete block walls	66	3	1	10	0

Concrete walls, ceilings	29	1	0	7	0
Concrete floors	5	0	0	5	0
Concrete rails	14	0	0	3	0
Concrete columns	18	0	0	5	0
Metal AC units	11	0	0	5	0
Metal exterior beams	5	0	0	5	0
Insulated pipe	1	0	0	0	0
Stair trim (vinyl)	1	0	0	0	0
Metal handrails	NA	NA	NA	NA	7
Roof ladder	1	0	0	0	0
Chair rail	2	0	0	0	0
Window sill	1	0	0	0	0
Totals	304	4	1	69	19

### 3.8 Abatement Requirements

In summary, the metal handrails located in the 15 stairwells are the only tested building components that have lead-based paint in quantities greater than the HUD threshold (0.5 % by weight lead).

Given the probability that the paint on the handrails will be subject to damage and deterioration (rust), the most likely abatement method is removal and replacement. The following are general abatement guidelines:

1. The handrails should be tested (Toxic Characteristic Leachate Procedure - TCLP) prior to abatement to determine whether they will constitute a hazardous waste as defined by federal and/or state RCRA regulations.
2. Depending upon the demolition method utilized, airborne lead concentrations generated during abatement may trigger the OSHA standard for lead in construction. The contractor should utilize methods that will reduce the chance of exposure to lead by workers. The use of personal protection equipment, medical surveillance, exposure monitoring, containment and engineering controls may be required, depending upon the method utilized.
3. Currently, proposed EPA regulations governing the certification of lead hazard abatement contractors and workers may be in effect at the time of abatement.

**SECTION 01300  
SUBMITTAL PROCEDURES  
(DESIGN-BUILD)**

**PART 1. GENERAL**

**1.1 SUBMITTAL CLASSIFICATION**

Submittals are classified as follows:

**1.1.1 SUBMITTAL DEFINITIONS**

The submittals described below are those required and further described in other sections of the specifications. Submittals required by the CONTRACT CLAUSES and other nontechnical (administrative, etc.) parts of the contract are not included in this section.

**SD-01 Data**

Work to be Performed by Contractor

Submittal Registers

Submittals which provide calculations, descriptions, or documentation regarding the work.

**SD-04 Drawings**

Submittals which graphically show relationship of various components of the work, schematic diagrams of systems, details of fabrication, layouts of particular elements, connections, and other relational aspects of the work.

As-Built Drawings

Equipment Layout Drawings

**SD-06 Instructions**

Preprinted material describing installation of a product, system or material, including special notices and material safety data sheets, if any, concerning impedances, hazards, and safety precautions.



## **SD-07 Schedules**

Progress Schedules

Schedules for Construction Contracts

Contractor Prepared Network Analysis

Tabular lists showing location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work.

## **SD-08 Statements**

Accident Prevention Plan

Hazard Analysis Plan

Environmental Protection Plan

Submittal Procedures

A document, required of the Contractor, or through the Contractor, from a supplier, installer, manufacturer, or other lower tier Contractor, the purpose of which is to confirm the quality or orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel, qualifications, or other verifications of quality.

## **SD-09 Reports**

Reports of inspections or tests, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used shall be identified and test results shall be recorded.

## **SD-13 Certificates**

Statement signed by responsible official of a manufacturer of a product, system or material, attesting that the product, system or material meets specified requirements. The statement must be dated after the award of this contract, must name the project, and must list the specific requirements which are being certified.

## **SD-14 Samples**

Samples, including both fabricated and unfabricated physical examples of materials, products, and units of work as complete units or as portions of units of work.

## **SD-18 Records**

Documentation to record compliance with technical or administrative requirements.

## **SD-19 Operations and Maintenance Manuals**

Data which forms a part of an operation and maintenance manual.

### **1.1.2 Designer of Record Approved**

Designer of Record approval is required for extensions of design, materials, any deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer's Representative. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings." The Contractor shall provide the Government the number of copies designated hereinafter of all Designer of Record approved submittals. The Government may review any or all Designer of Record approved submittals for conformance to the Solicitation and Accepted Proposal. The Government will review all submittals designated as deviating from the Solicitation or Accepted Proposal, as described below.

### **1.1.3 Government Approved**

Administrative Contracting Officer approval is required for any deviations from the Solicitation or Accepted Proposal and other items as designated by the Contracting Officer's Representative. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings."

### **1.1.4 Information Only**

All submittals not requiring Designer of Record or Government approval will be for information only. They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above.

## **1.2 GOVERNMENT REVIEWED OR "APPROVED" SUBMITTALS**

The Contracting Officer's Representative conformance review or approval of submittals shall not be construed as a complete check, but will indicate only that the design, general method of construction, materials, detailing and other information appear to meet the Solicitation and Accepted Proposal. Government Review or approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Design and CQC requirements of this contract is responsible for design, dimensions, all design extensions, such as the design of adequate connections and details, etc. and the satisfactory construction of all work. After submittals have been reviewed for conformance or approved, as applicable, by the Contracting Officer's Representative, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

## **1.3 DISAPPROVED SUBMITTALS**

The Contractor shall make all corrections required by the Contracting Officer's Representative, obtain the Designer of Record's approval, when applicable, and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal. Any "information only" submittal found to contain errors or unapproved deviations from the Solicitation or Accepted Proposal shall be resubmitted as one requiring "approval" action, requiring both Designer of Record and Government approval. If the Contractor considers any correction indicated by the Government on the submittals to constitute a change to the contract, a notice in accordance with the Contract Clause "Changes" shall be given promptly to the Contracting Officer's Representative.

## **1.4 WITHHOLDING OF PAYMENT**

No Payment for materials incorporated in the work will be made if all required Designer of Record or required Government approvals have not been obtained. No payment will be made for any materials incorporated into the work for any conformance review submittals or information only submittals found to contain errors or deviations from the Solicitation or Accepted Proposal.

## **PART 2 EXECUTION**

### **2.1 GENERAL**

The Contractor shall make submittals as required by the specifications. The Contracting Officer's Representative may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same as those used in the contract drawings. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Prior to submittal, the Contractor's Quality Control (CQC) representative, and the Designer of Record, as applicable, shall check, approve and stamp, sign, and date each item, indicating action taken. Proposed deviations from the contract requirements shall be clearly identified. Submittals shall include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals. Submittals requiring Government approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby. Samples remaining upon completion of the work shall be picked up and disposed of in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

### **2.2 SUBMITTAL REGISTER (ENG FORM 4288)**

The Contractor's Designer of Record shall develop a complete list of submittals during the design phase. The Designer of Record shall identify required submittals in the specifications. The list is to be used in preparing ENG Form 4288 Submittal Register or a computerized equivalent. The list is not all inclusive and additional submittals may be required by other parts of the contract. The contractor is required to complete ENG Form 4288 (including columns "a" through "r") and submit to the Contracting Officer for review, as soon as practicable, in accordance with the design schedule. The approved submittal register will serve as a scheduling document for submittals and will be used to control submittal actions throughout the contract period. The submit dates and need dates used in the submittal register shall be coordinated with dates in the contractor prepared progress schedule. Updates to the submittal register showing the contractor action codes and actual dates with government action

codes and actual dates shall be submitted monthly or until all submittals have been satisfactorily completed. When the progress schedule is revised, the submittal register shall also be revised and both submitted for approval.

### **2.3 SCHEDULING**

Submittals covering component items forming a system or items that are interrelated shall be scheduled to be coordinated and submitted concurrently. Certifications to be submitted with the pertinent drawings shall be so scheduled. Adequate time (a minimum of \_\_\_calendar days exclusive of mailing time) shall be allowed and shown on the register for Government review or approval. No delay damages or time extensions will be allowed for time lost in late submittals.

### **2.4 TRANSMITTAL FORM (ENG FORM 4025)**

The sample transmittal form (ENG Form 4025) attached to this section shall be used for transmitting both Government approved and information only submittals in accordance with the instructions on the reverse side of the form. These blank forms will be furnished to the Contractor. This form shall be properly completed by filling out all the heading blank spaces and identifying each item submitted. Special care shall be exercised to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.

### **2.5 SUBMITTAL PROCEDURE**

Submittals shall be made as follows:

#### **2.5.1 Procedures**

Detailed submittal procedures will be further discussed with the contractor at the pre-construction conference.

#### **2.5.2 Deviations**

For submittals which include proposed deviations requested by the Contractor, the column "variation" of ENG Form 4025 shall be checked. The Contractor shall set forth in writing the reason for any deviations and annotate such deviations on the submittal. As stated above, the Contractor's Designer of Record's approval is required for any proposed deviation. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

## **2.6 CONTROL OF SUBMITTALS**

The Contractor shall carefully control his procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register" so the material needed date is not threatened.

## **2.7 GOVERNMENT CONFORMANCE REVIEW AND APPROVED SUBMITTALS**

Upon completion of review of submittals requiring Government approval, the submittals will be identified as having received approval by being so stamped and dated. 4 copies of the submittal will be retained by the Contracting Officer's Representative and 2 copies of the submittal will be returned to the Contractor. If the Government performs a conformance review of other Designer of Record approved submittals, the submittals will be so identified and returned, as described above.

## **2.8 INFORMATION ONLY SUBMITTALS**

Normally submittals for information only will not be returned. Approval of the Contracting Officer's Representative is not required on information only submittals. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer's Representative from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe. Four (4) copies of information only submittals will be retained by the Government.

## **2.9 STAMPS**

Stamps used by the Contractor's Designer of Record and the Contractor's designated Quality Control person on the submittal data to certify that the submittal meets contract requirements shall be similar to the following (use two stamps for submittals reviewed by both):

CONTRACTOR

(Firm Name)

\_\_\_\_\_ Approved

\_\_\_\_\_ Approved with corrections as noted on submittal data  
and/or attached sheets(s).

SIGNATURE: \_\_\_\_\_

TITLE: \_\_\_\_ (DESIGNER OF RECORD) \_\_\_\_\_

DATE: \_\_\_\_\_

--End of Section--





## INSTRUCTIONS

1. Section I will be initiated by the Contractor in the required number of copies.
2. Each transmittal shall be numbered consecutively in the space provided for "Transmittal No.". This number, in addition to the contract number, will form a serial number for identifying each submittal. For new submittals or resubmittals mark the appropriate box; on resubmittals, insert transmittal number of last submission as well as the new submittal number.
3. The "Item No." will be the same "Item No." as indicated on ENG FORM 4288-R for each entry on this form.
4. Submittals requiring expeditious handling will be submitted on a separate form.
5. Separate transmittal form will be used for submittals under separate sections of the specifications.
6. A check shall be placed in the "Variation" column when a submittal is not in accordance with the plans and specifications--also, a written statement to that effect shall be included in the space provided for "Remarks".
7. Form is self-transmittal, letter of transmittal is not required.
8. When a sample of material or Manufacturer's Certificate of Compliance is transmitted, indicate "Sample" or "Certificate" in column c, Section I.
9. U.S. Army Corps of Engineers approving authority will assign action codes as indicated below in space provided in Section I, column i to each item submitted. In addition they will ensure enclosures are indicated and attached to the form prior to return to the contractor. The Contractor will assign action codes as indicated below in Section I, column g, to each item submitted.

### THE FOLLOWING ACTION CODES ARE GIVEN TO ITEMS SUBMITTED

A	--	Approved as submitted.	E	--	Disapproved (See attached).
B	--	Approved, except as noted on drawings.	F	--	Receipt acknowledged.
C	--	Approved, except as noted on drawings. Refer to attached sheet resubmission required.	FX	--	Receipt acknowledged, does not comply as noted with contract requirements.
D	--	Will be returned by separate correspondence.	G	--	Other ( <i>Specify</i> )

10. Approval of items does not relieve the contractor from complying with all the requirements of the contract plans and specifications.

*(Reverse of ENG Form 4025-R)*

SUBMITTAL REGISTER					SPECIFICATION SECTION									
DESIGN/CONSTRUCT RENOVATE DORMITORY 19, EGLIN AFB, FL					CONTRACTOR							CONTRACT NUMBER DACA01-97-R-0044		
ACTIV- ITY No. a	TRANS- MITTAL No. b	ITEM No. c	SPECIFICATION PARAGRAPH NUMBER d	DESCRIPTION OF ITEM SUBMITTED e thru n	CLASSI- FICATION * o thru q	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		REMARKS z
						SUBMIT r	APPROVAL NEEDED BY s	MATERIALS NEEDED BY t	CODE u	DATE v	SUBMIT TO GOVERN- MENT w	CODE x	DATE y	
			<b>01000</b>	<b>SD- 18 Records</b>										
				Hazardous Analysis	GA									
			<b>02080</b>	<b>SD- 01 Data</b>										
			1.13.	Asbestos Hazard Abatement Plan	GA									
			1.13.	Materials and Equipment	FIO									
			1.13.	Safety Plan	GA									
			<b>02080</b>	<b>SD- 04 Drawings</b>										
			1.13.	Site Layout	GA									
			<b>02080</b>	<b>SD- 08 Statements</b>										
			1.13.	Encapsulants	GA									
			1.13.	Certification of Medical Requirement	GA									
			1.13.	Training Material	FIO									
			1.13.	Employee Training and Certification	GA									
			1.13.	Landfill and Transporter Qualificatio	GA									
			1.13.	Designated Industrial Hygienist Qual	GA									

\* Classification: GA: Government Approved, FIO: For Information Only  
 ENG FORM 4428-E, Mar 95 (Revised Apr 96)

SUBMITTAL REGISTER					SPECIFICATION SECTION										
DESIGN/CONSTRUCT RENOVATE DORMITORY 19, EGLIN AFB, FL					CONTRACTOR							CONTRACT NUMBER DACA01-97-R-0044			
ACTIV- ITY No. a	TRANS- MITTAL No. b	ITEM No. c	SPECIFICATION PARAGRAPH NUMBER d	DESCRIPTION OF ITEM SUBMITTED e thru n	CLASSI- FICATION * o thru q	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		REMARKS z	
						SUBMIT r	APPROVAL NEEDED BY s	MATERIALS NEEDED BY t	CODE u	DATE v	SUBMIT TO GOVERN- MENT w	CODE x	DATE y		
			1.13.	Qualification	GA										
			<b>02080</b>	<b>SD- 09 Reports</b>											
			1.13.	Air Sampling Results	GA										
			1.13.	Field Tests	FIO										
			1.13.	Notifications	GA										
			1.13.	Pressure Differential Recordings	FIO										
			<b>02080</b>	<b>SD- 13 Certificates</b>											
			1.13.	Vacuum, Filtration and Ventilation E	FIO										
			<b>02080</b>	<b>SD- 18 Records</b>											
			1.13.	Respirator Program	GA										
			1.13.	Asbestos Waste Shipment	GA										
			<b>02090</b>	<b>SD- 08 Statements</b>											
			1.2.	Waste Disposal Plan	GA										
			1.2.	Hazardous Waste Management Pla	GA										
			1.2.	Lead-Based Paint (LBP) Manageme	GA										

\* Classification: GA: Government Approved, FIO: For Information Only  
 ENG FORM 4428-E, Mar 95 (Revised Apr 96)

SUBMITTAL REGISTER					SPECIFICATION SECTION									
DESIGN/CONSTRUCT RENOVATE DORMITORY 19, EGLIN AFB, FL					CONTRACTOR							CONTRACT NUMBER DACA01-97-R-0044		
ACTIV- ITY No. a	TRANS- MITTAL No. b	ITEM No. c	SPECIFICATION PARAGRAPH NUMBER d	DESCRIPTION OF ITEM SUBMITTED e thru n	CLASSI- FICATION * o thru q	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		REMARKS z
						SUBMIT r	APPROVAL NEEDED BY s	MATERIALS NEEDED BY t	CODE u	DATE v	SUBMIT TO GOVERN- MENT w	CODE x	DATE y	
			<b>02090</b>	<b>SD- 09 Reports</b>										
			1.2.	Sampling Result	GA									
			<b>02090</b>	<b>SD- 13 Certificates</b>										
			1.2., 1.3.	Quality Assurance	GA									
			<b>02950</b>	<b>SD- 01 Data</b>										
			1.2.	Maintenance Instructions	GA									
			<b>09915</b>	<b>SD- 14 Samples</b>										
			1.2.	Color board	GA									
			<b>10431</b>	<b>SD- 01 Data</b>										
			1.3.	Signage	GA									
			<b>10431</b>	<b>SD- 04 Drawings</b>										
			1.3.	Signage	GA									
			<b>10431</b>	<b>SD- 06 Instructions</b>										
			1.3.	Signage	FIO									
			<b>10431</b>	<b>SD- 14 Samples</b>										

SUBMITTAL REGISTER					SPECIFICATION SECTION									
DESIGN/CONSTRUCT RENOVATE DORMITORY 19, EGLIN AFB, FL					CONTRACTOR							CONTRACT NUMBER DACA01-97-R-0044		
ACTIV- ITY No. a	TRANS- MITTAL No. b	ITEM No. c	SPECIFICATION PARAGRAPH NUMBER d	DESCRIPTION OF ITEM SUBMITTED e thru n	CLASSI- FICATION * o thru q	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		REMARKS z
						SUBMIT r	APPROVAL NEEDED BY s	MATERIALS NEEDED BY t	CODE u	DATE v	SUBMIT TO GOVERN- MENT w	CODE x	DATE y	
			1.3.	Signage	GA									

\* Classification: GA: Government Approved, FIO: For Information Only  
ENG FORM 4428-E, Mar 95 (Revised Apr 96)

## SECTION 01440

### CONTRACTOR QUALITY CONTROL 10/94

#### **PART I. GENERAL**

##### **1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

##### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3740 (1992) Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

ASTM E 329 (1993b) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

##### **1.2 PAYMENT**

Separate payment will not be made for providing and maintaining an effective Quality Control program, and all costs associated therewith shall be included in the applicable unit prices or lump-sum prices contained in the Bidding Schedule.

#### **PART 2 PRODUCTS (Not Applicable)**

#### **PART 3 EXECUTION**

##### **3.1 GENERAL**

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the Contract Clause entitled "Inspection of Construction." The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all design/construction operations, both onsite and offsite, and shall be keyed to the proposed design/construction operations sequence. The project superintendent will be held responsible for the quality of work on the job and is subject to removal by the Contracting Officer for non-compliance with quality requirements specified in the contract. The project superintendent in this context shall mean the highest ranking on-site individual with responsibility for the overall management of the project including quality and production.

##### **3.2 QUALITY CONTROL PLAN**

###### **3.2.1 General**

The Contractor shall furnish for review by the Government, not later than 15 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause entitled "Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, test, records, and forms to be used. The Government will consider an interim plan for the first 30 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan

or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started.

### **3.2.2 Content of the CQC Plan**

The CQC Plan shall include, as a minimum, the following to cover all design/construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents:

- a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC System Manager who shall report to the project superintendent.
- b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.
- c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters will also be furnished to the Government.
- d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with Section 01300 SUBMITTAL DESCRIPTIONS.
- e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities will be approved by the Contracting Officer.)
- f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.
- g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures will establish verification that identified deficiencies have been corrected.
- h. Reporting procedures, including proposed reporting formats.
- i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks and has separate control requirements. It could be identified by different trades or disciplines, or it could be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable feature under a particular section. This list will be agreed upon during the coordination meeting.

### **3.2.3 Acceptance of Plan**

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

#### **3.2.4 Notification of Changes**

After acceptance of the CQC Plan, the Contractor shall notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

### **3.3 COORDINATION MEETING**

After the Preconstruction Conference, before start of construction, and prior to acceptance by the Government of the CQC Plan, the Contractor shall meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. The CQC Plan shall be submitted for review a minimum of 5 calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting shall be prepared by the Government and signed by both the Contractor and the Contracting Officer.

The minutes shall become a part of the contract file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

### **3.4 QUALITY CONTROL ORGANIZATION**

#### **3.4.1 General**

The requirements for the CQC organization are a CQC System Manager and sufficient number of additional qualified personnel to ensure contract compliance. The Contractor shall provide a CQC organization which shall be at the site at all times during progress of the work and with complete authority to take any action necessary to ensure compliance with the contract. All CQC staff members shall be subject to acceptance by the Contracting Officer.

#### **3.4.2 CQC Staff**

Following are the minimum requirements for the CQC staff. These minimum requirements will not necessarily assure an adequate staff to meet the CQC requirements at all time during construction. The actual strength of the CQC staff may vary during any specific work period to cover the needs of the work period. When necessary for a proper CQC organization, the Contractor will add additional staff at no cost to the Government. This listing of minimum staff in no way relieves the Contractor of meeting the basic requirements of quality construction in accordance with contract requirements. All CQC staff members shall be subject to acceptance by the Contracting Officer.

#### **3.4.3 CQC System Manager**

(TO BE ADDED BY AMENDMENT)



#### 3.4.4 CQC Personnel

(TO BE ADDED BY AMENDMENT)

#### Experience Matrix

Area	Qualifications
a. Civil performed or technician related experience	Graduate Civil Engineer with 2 years experience in the type of work being on this project with 5 yrs
b. Mechanical	Graduate Mechanical Engineer with 2 yrs experience or person with 5 yrs related experience
c. Electrical experience yrs related	Graduate Electrical Engineer with 2 yrs related or person with 5 experience
d. Structural	Graduate Structural Engineer with 2 yrs experience or person with 5 yrs related experience
e. Architectural	Graduate Architect with 2 yrs experience or person with 5 yrs related experience
f. Environmental	Graduate Environmental Engineer with 3 yrs

	experience
g. Submittals	Submittal Clerk with 1 yrs experience
h. Occupied family housing experience	Person, customer relations type, coordinator
i. Concrete, Pavements and Soils	Materials Technician with 2 yrs experience for the appropriate area

#### **3.4.5 Additional Requirement**

In addition to the above experience and education requirements the CQC System Manager shall have completed the course entitled "Construction Quality Management For Contractors". This course is periodically offered by the Corps of Engineers within the Mobile Engineer District.

#### **3.4.6 Organizational Changes**

The Contractor shall maintain his CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

### **3.5 SUBMITTALS**

Submittals shall be made as specified in Section 01300 SUBMITTAL DESCRIPTIONS. The CQC organization shall be responsible for certifying that all submittals are in compliance with the contract requirements.

### **3.6 CONTROL**

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control shall be conducted by the CQC System Manager for each definable feature of work as follows:

#### **3.6.1 Preparatory Phase**

This phase shall be performed prior to beginning work on each definable feature of work and shall include:

- a. A review of each paragraph of applicable specifications.
- b. A review of the contract drawings.
- c. A check to assure that all materials and/or equipment have been tested, submitted, and approved.
- d. Review of provisions that have been made to provide required control inspection and testing.
- e. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.
- f. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.

- g. A review of the appropriate activity hazard analysis to assure safety requirements are met.
- h. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.
- i. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.
- j. Discussion of the initial control phase.
- k. The Government shall be notified at least 24 hours in advance of beginning the preparatory control phase. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The results of the preparatory phase actions shall be documented by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

### **3.6.2 Initial Phase**

This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:

- a. A check of work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.
- b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing.
- c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.
- d. Resolve all differences.
- e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
- f. The Government shall be notified at least 24 hours in advance of beginning the initial phase. Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the daily CQC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.
- g. The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

### **3.6.3 Follow-up Phase**

Daily checks shall be performed to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work. The

Contractor shall not build upon or conceal non-conforming work.

#### **3.6.4 Additional Preparatory and Initial Phases**

Additional preparatory and initial phases shall be conducted on the same definable features of work if the quality of on-going work is unacceptable, if there are changes in the applicable CQC staff, onsite production supervision or work crew, if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

### **3.7 TESTS**

#### **3.7.1 Testing Procedure**

The Contractor shall perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, the Contractor shall furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of a Corps of Engineers approved testing laboratory or establish an approved testing laboratory at the project site. The Contractor shall perform the following activities and record and provide the following data:

- a. Verify that testing procedures comply with contract requirements.
- b. Verify that facilities and testing equipment are available and comply with testing standards.
- c. Check test instrument calibration data against certified standards.
- d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
- e. Results of all tests taken, both passing and failing tests, will be recorded on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test will be given. If approved by the Contracting Officer, actual test reports may be submitted later with a reference to the test number and date taken. An information copy of tests performed by an offsite or commercial test facility will be provided directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

#### **3.7.2 Testing Laboratories**

##### **3.7.2.1 Capability Check**

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel shall meet criteria detailed in ASTM D 3740 and ASTM E 329.

##### **3.7.2.2 Capability Recheck**

If the selected laboratory fails the capability check, the Contractor will be assessed a charge of for inspection to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the contract amount due

the Contractor.

### **3.7.3 On-Site Laboratory**

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

### **3.7.4 Furnishing or Transportation of Samples for Testing**

Costs incidental to the transportation of samples or materials will be borne by the Contractor. Samples of materials for test verification and acceptance testing by the Government shall be delivered to the Corps of Engineers Division Laboratory, f.o.b., at the following address:

- (i) All Samples, except as in items (ii) and (iii) below:  
South Atlantic Division Laboratory  
U. S. Army, Corps of Engineers  
611 South Cobb Drive (State Highway 280)  
P. O. Box 51  
Marietta, GA 30061
- (ii) For paint tests and analyses only, the samples shall be shipped or delivered to:  
Missouri River Division Laboratory  
U. S. Army, Corps of Engineers  
420 South 18th Street  
Omaha, NE 68102
- (iii) To a local commercial laboratory as directed by the Contracting Officer.

Coordination for each specific test, exact delivery location, and dates will be made through the Area Office.

## **3.8 COMPLETION INSPECTION**

### **3.8.1 CQC Inspection prior to Pre-Final**

At the completion of all work or any increment thereof as established by a completion time stated in the Special Contract Clause entitled "Commencement, Prosecution, and Completion of Work", or stated elsewhere in the specifications, the CQC System Manager shall conduct a CQC inspection of the work and develop a "punch list" of items which do not conform to the approved drawings and specifications. Such a list of deficiencies shall be included in the CQC documentation, as required by paragraph DOCUMENTATION below, and shall include the estimated date by which the deficiencies will be corrected. The purpose of this CQC inspection is to verify for the Contractor that the work is ready for a pre-final inspection.

### **3.8.2 Pre-Final Inspection**

Once all the above deficiencies are corrected the Contractor shall notify the Government that the facility is complete and is ready for the Government's "Prefinal" inspection. The Government will perform this inspection with the Contractor to verify that the facility is complete and ready to be occupied. A Government "Prefinal Punch List" will be developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected and so notify the Government so that a "Final Acceptance Inspection" with the customer can be scheduled.

### **3.8.3 Final Acceptance Inspection**

The final acceptance inspection will be formally scheduled by the Contracting Officer based upon notice from the Contractor. This notice will be given to the Contracting Officer at least 14 days prior to the final acceptance inspection and must include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work to be performed under the contract, will be completed and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause entitled "Inspection of Construction". The Contractor's Quality Control Inspection personnel, his superintendent or other primary management person and the Contracting Officer's Representative will be in attendance at the final acceptance inspection. Additional Government personnel including, but not limited to, those from Base/Post/Civil Facility Engineer, other user groups, and major commands may also be in attendance. These inspections and any deficiency corrections required by this paragraph will be accomplished within the time stated for completion of the contract work or any particular increment thereof if the project is divided into increments by separate completion dates.

### **3.9 DOCUMENTATION**

The Contractor shall maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers and shall be on an acceptable form that includes, as a minimum, the following information:

- a. Contractor/subcontractor and their area of responsibility.
- b. Operating plant/equipment with hours worked, idle, or down for repair.
- c. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.
- d. Test and/or control activities performed with results and references to specifications/drawings requirements. The control phase should be identified (Preparatory, Initial, Follow-up). List deficiencies noted along with corrective action.
- e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.
- f. Submittals reviewed, with contract reference, by whom, and action taken.
- g. Off-site surveillance activities, including actions taken.
- h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
- i. Instructions given/received and conflicts in plans and/or specifications.
- j. Contractor's verification statement.

These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and one copy of these records in report form shall be furnished to the Government daily within 24 hours after the date(s) covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, one report shall be prepared and submitted for every seven days of no work and on the last day of a no work period. All calendar days shall be accounted for throughout the life of the contract. The first report following a day of no work shall be for that day only. Reports shall be signed and dated by the CQC System Manager. The report from the CQC System Manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel.

### **3.10 SAMPLE FORMS**

Sample forms enclosed at the end of this section.

### **3.11 NOTIFICATION OF NONCOMPLIANCE**

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the worksite, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

--END OF SECTION--





4. VERBAL INSTRUCTIONS RECEIVED: (List any instructions given by Government personnel on construction deficiencies. retesting required, etc., with action to be taken.)

5. REMARKS: (Cover any conflicts in plans, specifications or instructions: acceptability of incoming materials: offsite surveillance activities; progress of work, delays, causes and extent thereof; days of no work with reasons for same.)

6. SAFETY: (Include any infractions of approved safety plan, safety manual or instructions from Government personnel. Specify corrective action taken.)

INSPECTOR

CONTRACTOR'S CERTIFICATION: I certify that the above report is complete and correct and that all material and equipment used, work performed and tests conducted during this reporting period were in strict compliance with the contract plans and specifications except as noted above.

CONTRACTOR'S APPROVED AUTHORIZED REPRESENTATIVE

## SECTION 01560

### ENVIRONMENTAL PROTECTION

#### PART 1 GENERAL

##### 1.1 SCOPE

This section covers prevention of environmental pollution and damage as the result of renovation operations under this contract and for those measures set forth in other Technical Provisions of these specifications. For the purpose of this specification, environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environment for aesthetic, cultural and/or historical purposes. The control of environmental pollution and damage requires consideration of air, water, and land resources; and includes management of visual aesthetics; noise; solid; chemical; and liquid waste; radiant energy and radioactive materials; as well as other pollutants.

##### 1.2 QUALITY CONTROL

The Contractor shall establish and maintain quality control for environmental protection of all items set forth herein. The Contractor shall record on daily reports any problems in complying with laws, regulations and ordinances and corrective action taken. Copies of these records will be furnished to the Government as directed by the Contracting Officer's Representative.

##### 1.3 SUBMITTALS

SD-01 Data

Environmental Protection Plan; GA; CD

The Environmental Protection Plan shall include but not be limited to the following:

a. A list of Federal, State and local laws, regulations, and permits concerning environmental protection, pollution control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations and permits. NOTE: The Contractor shall perform all work in compliance with the provisions of the Contract and applicable Federal, State, and local environmental laws and regulations. The Contractor is advised that it is the Contractor's responsibility to obtain all necessary permits, licenses, and authorizations for a project.

b. Procedures to be implemented to comply with the applicable laws and regulations. The Contractor shall set out the procedures to be followed to correct pollution of the environment due to accident, natural causes or failure to follow the procedures set out in accordance with the environmental protection plan.

c. The Contractor shall develop a plan specifying how and where waste will be disposed. Include permit or license and location of the solid waste disposal area.

d. Drawings showing locations of any proposed material storage areas, structures, and sanitary facilities.

e. Traffic control plan for the job site.

f. Methods of protection for surface and ground water during renovation activities. These waters shall be protected from pollutants such as petroleum products, fuels, oils, lubricants, bentonite, bitumens, calcium chloride, acids, waste washings, sewage, chlorinated solutions, herbicides, insecticides, lime, wet concrete, cement, silt, or organic or other deleterious material. Chemical emulsifiers, dispersant, coagulants, or other cleanup compounds shall not be used without prior written approval from the Contracting Officer's Representative. Waters used to wash equipment shall be disposed of in an acceptable quality. Fuels, oils, greases, bitumens, chemicals, and other nonbiodegradable materials shall be contained with total containment systems and removed from the site.

g. Noise control plan for the job site. The Contractor shall keep renovation activities under surveillance and shall exercise all necessary controls to minimize damage to the environment by noise from equipment and various renovation activities. All Contractor's, subcontractor's, and repetitious supplier's equipment used on or in the vicinity of the job site shall be equipped with the best generally available noise suppression devices. Equipment not so suppressed and properly maintained must be approved for use in writing by the Contracting Officer's Representative. Areas that have noise levels great than 85 dB continuous or 140 dB peak (unweighted) impulse must be designated as noise hazardous areas. These work areas must have caution signs displayed at the perimeter of the noise area indicating the presence of hazardous noise levels and requiring the use of hearing protection devices.

h. Work area plan showing the proposed activity in each portion of the area and identify the areas of limited use or nonuse. The plan should include measures for marking the limits of use areas.

i. Contaminant Prevention Statement. Prior to initiating any renovation, the Contractor shall prepare a contaminant prevention statement which identifies all potentially hazardous substances on the job site and the intended actions to be taken to prevent the accidental or intentional introduction of such materials into the air, the water or the ground. The Contractor shall also detail special provisions taken to meet Federal, State, and local laws and regulations regarding the storage and handling of these materials. The statement shall also include but not be limited to plans for preventing polluted runoff from equipment parking, and maintenance areas from entering local surface and groundwater sources.

#### Containment and Cleanup Plan; GA; CD

The Contractor shall provide the Contracting Officer's Representative a containment and cleanup plan including the procedures, instructions, and reports to be used in the event of an unforeseen oil or hazardous substance release. This plan shall include as a minimum:

(a) The name of the individual who will be responsible for implementing and supervising the containment and cleanup.

(b) A list of materials and equipment to be immediately available. For all work in or adjacent to water the following equipment shall be available at the job site: 1) a containment boom at least 200 feet in length, 2) skimming equipment, and 3) a cleanup kit. Materials and equipment for other cleanup work shall be tailored to the potential hazards involved.

(c) The names and locations of suppliers of containment materials and locations of additional fuel oil recovery, cleanup, restoration, and material placement equipment available in case of an unforeseen spill emergency.

(d) The methods and procedures to be used for expeditious cleanup.

(e) The name of the individual who will report any spills or hazardous substance releases and who will follow up with complete documentation. This individual must immediately notify the Contracting Officer's Representative, in addition to the legally required reporting channels, when a reportable quantity spill of oil or hazardous substance occurs.

#### **1.4 Implementation of Environmental Protection Plan**

After receipt of Notice of Award of the Contract and at least 7 days prior to the Preconstruction Conference, the Contractor shall submit in writing the above Environmental Protection Plan, and shall meet with representatives of the Contracting Officer's Representative to develop mutual understanding relative to compliance with this provision and administration of the environmental protection program. No physical work at the site shall begin until the Contracting Officer's Representative has approved the above work plan(s) or provided specific authorization to start a phase of the work. Preparation and submittal of supplemental plans may be required if additional environmental protection planning is found necessary for later phases of work. Approval of the Contractor's plan will not relieve the Contractor of responsibility for complying with all applicable environmental laws or regulations, for performing adequate and continuing control of pollutants, and for taking other required environmental protection measures. The Government reserves the right to make changes in the above plans and operations as necessary to maintain satisfactory environmental protection performance.

#### **1.5 SUBCONTRACTORS**

Compliance with the provisions of this section by subcontractors will be the responsibility of the Contractor.

#### **1.6 NOTIFICATION**

The Contracting Officer's Representative will notify the Contractor in writing of any observed noncompliance with Federal, State or local laws, regulations, permits and other elements. The Contractor shall, after receipt of such notice, inform the Contracting Officer's Representative of proposed corrective action and take such action as may be approved. Such notice, when delivered to the Contractor or his authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails or refuses to comply promptly, the Contracting Officer's Representative may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of a claim for extension of time or for excess costs or damages by the Contractor unless it was later determined that the Contractor was in compliance.

### **PART 2 PRODUCTS (NOT APPLICABLE)**

### **PART 3 EXECUTION**

#### **3.1 PROTECTION OF ENVIRONMENTAL RESOURCES**

The environmental resources within the project boundaries and those affected outside the limits of permanent work under this contract shall be protected during the entire period of this contract. The Contractor shall confine his activities to areas defined by the drawings and specifications. If during renovation activities the Contractor becomes aware of the presence of pre-project hazardous, toxic or radioactive wastes, all personnel are to leave the

work area and the Contractor will immediately report the find to the Contracting Officer's Representative. Environmental protection and replacement shall be as stated in the following paragraphs:

### **3.1.1 Protection of Land Resources**

Activities shall be confined to areas defined by the plans and specifications. The land resources within the project boundaries and outside the limits of work under this contract shall be preserved in their present condition or be restored to an equivalent or improved condition upon completion of the work. Prior to initiating any renovation, the Contractor shall identify all land resources to be preserved within the Contractor's work area. The Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, and land forms without special permission from the Contracting Officer's Representative. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. Where such special emergency use is permitted, the Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs:

#### **3.1.1.1 Protection of Landscape**

The Contractor shall not deface, injure, or destroy trees or shrubs, nor remove or cut them without special authority. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorage unless specifically authorized by the Contracting Officer's Representative. Monuments, markers and works of art shall be protected similarly before beginning operations near them. A pre-construction survey shall be performed by the Contractor and the Contracting Officer's Representative prior to performing any construction. The purpose of this pre-construction survey is to document existing conditions (prior to construction) as to provide a comparison with subsequent post-construction conditions.

#### **3.1.1.2 Disposal of Solid Wastes**

Solid wastes includes any waste generated by the Contractor which meets the most complete definition of solid waste as described by Federal, State, and local laws and regulations. Solid wastes shall be placed in containers which are emptied on a regular schedule. The Contractor shall transport all solid waste off Government property and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal. All handling and disposal shall be conducted to prevent spillage and contamination. The Contractor will participate in any State or local recycling programs and reduce the volume of solid waste materials at the source whenever practical.

#### **3.1.1.3 Disposal of Chemical Waste**

Chemical waste shall be stored in corrosion resistant containers, removed from the work area and disposed of in accordance with Federal, State, and local regulations.

#### **3.1.1.4 Disposal of Discarded Materials**

Discarded materials other than those which can be included in the solid waste category will be handled as directed by the Contracting Officer's Representative.

#### **3.1.1.5 Disposal of Hazardous Wastes**

Asbestos waste shall be handled according to Section 02080 ASBESTOS ABATEMENT. Lead paint waste shall be handled according to Section 02090 LEAD-BASED PAINT (LBP) ABATEMENT AND DISPOSAL. Hazardous waste shall be stored, removed from

the work area and disposed of in accordance with Federal, State and local laws and regulations. Hazardous waste shall not be dumped onto the ground, into storm sewers or open watercourses, or into the sanitary sewer system. Fueling and lubrication of equipment and motor vehicles shall be conducted in a manner that affords the maximum protection against spills and evaporation. Lubricants and waste oil to be discarded shall be stored in corrosion-resistant containers and disposed of as stated above.

### **3.1.2 Preservation and Recovery of Historical, Archeological and Cultural Resources**

Existing historical, archeological and cultural resources within the Contractor's work area will be so designated by the Contracting Officer's Representative. The Contractor shall take necessary precautions to preserve all such resources in their pre-project state. If during renovation activities the Contractor observes items that might have historic or archeological value (i.e., when Native American human remains and/or associated objects are inadvertently discovered), the Contractor shall stop work in the area of the discovery, leave the items undisturbed and immediately report the find to the Contracting Officer's Representative so that proper authorities can be notified. All items having any apparent historical or archeological interest which are discovered in the course of any renovation activities shall be carefully preserved.

### **3.1.3 Protection of Air Resources**

The Contractor shall keep renovation activities under surveillance, management and control to minimize pollution of air resources. All activities, equipment, processes, and work operated or performed by the Contractor in accomplishing the specified renovation shall be in strict accordance with all Federal, State, and local emission and performance laws and standards. Dust particles from all renovation activities shall be controlled at all times. Special management techniques as set out below shall be implemented to control air pollution by the renovation activities which are included in the contract. See Section 02080 ASBESTOS ABATEMENT, for monitoring and managing asbestos fibers made airborne during abatement activities.

#### **3.1.3.1 Particulate**

Dust particles, aerosols, and gaseous by-products from all renovation activities shall be controlled at all times, including weekends, holidays and hours when work is not in progress.

#### **3.1.3.2 Hydrocarbons and Carbon Monoxide**

Hydrocarbons and carbon monoxide emissions from equipment shall be controlled to Federal and State allowable limits at all times.

#### **3.1.3.3 Volatile Organic Compound (VOC)**

The Contractor shall comply with Federal, State and local laws and regulations pertaining to emission of VOC vapors at all times.

#### **3.1.3.4 Odors**

Odors shall be controlled at all times for all renovation activities, processing and preparation of materials.

#### **3.1.3.5 Monitoring Air Quality**

Monitoring of air quality shall be the responsibility of the Contractor. All air areas affected by the renovation activities shall be monitored by the Contractor.

#### **3.1.4 Burning**

Material may not be burned within the contract area.

#### **3.1.5 Inspection**

When the Contracting Officer's Representative notifies the Contractor in writing of any observed noncompliance with Federal, State, or local laws, regulation, or permits, the Contractor shall, after receipt of such notice, inform the Contracting Officer's Representative of proposed corrective action and take such action as may be approved. If the Contractor fails to comply promptly, the Contracting Officer's Representative may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions will be granted or costs or damages allowed to the Contractor for any such suspension.

### **3.2 POST-CONSTRUCTION CLEANUP**

The Contractor shall clean up areas used for construction and remove all signs of temporary construction facilities, Contractor office, storage and staging areas and any other vestiges of construction within the project area shall be removed, as directed by the Contracting Officer's Representative.

### **3.3 RESTORATION OF LANDSCAPE DAMAGE**

The Contractor shall restore all landscape features damaged or destroyed during construction operations that were not identified for removal. Any vegetation or landscape feature damaged shall be restored as nearly as possible to its original condition. The Contracting Officer's Representative will decide what method of restoration shall be used and whether the damaged vegetation shall be treated and healed or removed and replaced with similar species and dimension, if possible. The restoration work shall be in accordance with a plan submitted for approval by the Contracting Officer's Representative. This work will be accomplished at the Contractor's expense.

### **3.4 MAINTENANCE OF POLLUTION CONTROL FACILITIES**

During the life of this contract, the Contractor shall maintain all facilities constructed for pollution control and all portable pollution control devices used under this contract for as long as the operations creating the particular pollutant are being carried out or until the material concerned has been stabilized to the extent that pollution is no longer being created.

### **3.5 TRAINING OF CONTRACTOR PERSONNEL IN POLLUTION CONTROL**

Early in the construction period, the Contractor shall conduct a training course for employees and subcontractors that will emphasize all phases of environmental protection. In addition, the Contractor shall conduct environmental protection meetings in conjunction with monthly supervisor safety meetings. The training and meeting agenda shall include methods of detecting and avoiding pollution, familiarization with pollution standards, both statutory and contractual, and installation and care of facilities to ensure adequate and continuous environmental pollution control. Personnel are to be

informed of provisions to be taken for hazardous and toxic material container labeling and for managing Material Safety Data Sheets (MSDS). Anticipated hazardous or toxic chemicals shall also be reviewed. Other items to be discussed shall include recognition and protection of archeological sites and artifacts.

### **3.6 ENVIRONMENTAL LITIGATION**

a. If the performance of all or any part of the work is suspended, delayed, or interrupted due to an order of a court of competent jurisdiction as a result of environmental litigation, as defined below, the Contracting Officer's Representative, at the request of the Contractor, shall determine whether the order is due in any part to acts or omissions of the Contractor, or subcontractor at any tier, not required by the terms of the contract. If it is determined that the order is not due in any part to acts or omissions of the Contractor, or a Subcontractor at any tier, other than as required by the terms of this contract, such suspension, delay, or interruption shall be considered reasonable, and an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) as provided in that clause, subject to all the provisions thereof.

b. The term "environmental litigation", as used herein, means a lawsuit alleging that the work will have an adverse effect on the environmental or that the Government has not duly considered, either substantively or procedurally, the effect of the work on the environment.

### **3.7 PAYMENT**

No separate payment or direct payment will be made for the cost of the work covered under this section, and such work will be considered as an integral part of the Contract. Furthermore, before this Contract is completed, all restoration, cleanup, and other work required to leave the site and material placement area(s) in an acceptable condition shall have been completed. Final payment will not be made until the environmental protection requirements have been met.

--End of Section--



SECTION 02080  
ASBESTOS ABATEMENT  
03/92

**PART I. GENERAL**

See "Description of Work" below for specifics tasks to be accomplished.

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- |            |   |
|------------|---|
| ANSI Z9.2  | (1979; R 1991) Fundamentals Governing the Design and Operation of Local Exhaust Systems |
| ANSI Z87.1 | (1989; Errata; Z87.1a) Occupational and Educational Eye and Face Protection             |
| ANSI Z88.2 | (1992) Respiratory Protection   |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- |             |  |
|-------------|--|
| ASTM C 732  | (1982; R 1987) Aging Effects of Artificial Weathering on Latex Sealants                    |
| ASTM D 522  | (1993a) Mandrel Bend Test of Attached Organic Coatings                                     |
| ASTM D 1331 | (1989) Surface and Interfacial Tension of Solutions of Surface-Active Agents               |
| ASTM D 2794 | (1993) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)         |
| ASTM D 4397 | (1991) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications   |
| ASTM E 84   | (1991a) Surface Burning Characteristics of Building Materials                              |
| ASTM E 96   | (1993) Water Vapor Transmission of Materials   |
| ASTM E 119  | (1988) Fire Tests of Building Construction and Materials                                   |
| ASTM E 736  | (1992) Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members |
| ASTM E 1368 | (1990) Visual Inspection of Asbestos Abatement Projects                                    |

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1926	Safety and Health Regulations for Construction
40 CFR 61	National Emission Standards for Hazardous Air Pollutants
40 CFR 763	Asbestos

COMPRESSED GAS ASSOCIATION (CGA)

CGA G-7	(1990) Compressed Air for Human Respiration
CGA G-7.1	(1989) Commodity Specification for Air

ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 340/1-90-018	(1990) Asbestos/NESHAP Regulated Asbestos Containing Materials Guidance
EPA 340/1-90-019	(1990) Asbestos/NESHAP Adequately Wet Guidance
EPA 560/5-85-024	(1985) Guidance for Controlling Asbestos-Containing Materials in Buildings

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10	(1990) Portable Fire Extinguishers
NFPA 70	(1993) National Electrical Code
NFPA 90A	(1993) Installation of Air Conditioning and Ventilating Systems
NFPA 101	(1994) Safety to Life from Fire in Buildings and Structures
NFPA 701	(1989) Methods of Fire Test for Flame-Resistant Textiles and Films

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH Pub No. 84-100	(1984; Supple 1985, 1987, 1988 & 1990) NIOSH Manual of Analytical Methods
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UNDERWRITERS LABORATORIES (UL)

UL 586	(1990) High-Efficiency, Particulate, Air Filter Units
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**1.2 DEFINITIONS**

**1.2.1 Adequately Wet**

A term as defined in 40 CFR 61, Subpart M and EPA 340/1-90-019 that means to sufficiently mix or penetrate with liquid to prevent the release of particulate. If visible emissions are observed coming from asbestos-containing material (ACM), then that material has not been adequately wetted.

However, the absence of visible emissions is not sufficient evidence of being adequately wetted.

#### **1.2.2 Amended Water**

Water containing a wetting agent or surfactant with a surface tension of at least 29 dynes per square centimeter when tested in accordance with ASTM D 1331.

#### **1.2.3 Friable ACM**

A term as defined in 40 CFR 61, Subpart M and EPA 340/1-90-018 that means any material containing more than 1 percent asbestos as determined using the method specified in 40 CFR 763, Appendix A, Subpart F, Section 1, Polarized Light Microscopy, that when dry, can be crumbled, pulverized, or reduced to powder by hand pressure. If the asbestos content is less than 10 percent as determined by a method other than point counting by polarized light microscopy (PLM), verify the asbestos content by point counting using PLM.

#### **1.2.4 Nonfriable ACM**

A term as defined in 40 CFR 61, Subpart M and EPA 340/1-90-018 that means any material containing more than 1 percent asbestos as determined using the method specified in 40 CFR 763, Appendix A, Subpart F, Section 1, Polarized Light Microscopy, that, when dry, cannot be crumbled, pulverized or reduced to powder by hand pressure.

#### **1.2.5 Category I Nonfriable ACM**

A term as defined in 40 CFR 61, Subpart M and EPA 340/1-90-018 that means asbestos-containing packings, gaskets, resilient floor covering, and asphalt roofing products containing more than 1 percent asbestos as determined using the method specified in 40 CFR 763, Appendix A, Subpart F, Section 1, Polarized Light Microscopy.

#### **1.2.6 Category II Nonfriable ACM**

A term as defined in 40 CFR 61, Subpart M and EPA 340/1-90-018 that means any material, excluding Category I nonfriable ACM, containing more than 1 percent asbestos as determined using the methods specified in Appendix A, Subpart F, 40 CFR 763, Section 1, Polarized Light Microscopy, that when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

#### **1.2.7 Asbestos Regulated Work Area**

An asbestos regulated work area is an area contained and controlled either by an enclosed containment (full containment area, single or double bulkhead containment area, mini-containment area), modified containment, glove bag or outdoor techniques, where asbestos containing materials (ACM) operations are performed and isolated by physical boundaries to prevent the spread of ACM and control access to authorized persons. A full containment, single or double bulkhead containment area, mini-containment area, modified containment, and glove bag work area is isolated within a containment enclosure in which ACM operations are performed. An outdoor regulated work area is not isolated within a containment enclosure, but is otherwise secured by means of physical barriers, boundary warning tape, and signage, etc., to control access by unauthorized persons.

#### **1.2.8 Time-Weighted Average (TWA)**

The TWA is an 8-hour time weighted average of airborne concentration of fibers (longer than 5 micrometers) per cubic centimeter of air which represents the employee's 8-hour workday as determined by Appendix A of 29 CFR 1926, Section 1926.58.

#### **1.3 DESCRIPTION OF WORK**

See specification section 01100, "Asbestos and Lead Paint Survey" for testing and survey results. See contract drawings H-1 through H-3 for location of asbestos containing material. See TABLE 1 of this specification for quantities of asbestos to be removed.

**1.3.1 The Contractor shall remove the following architectural asbestos containing material from Sector D:**

a. Exposed floor mastic (where floor covering was previously removed) in storage rooms.

b. Textured ceiling sprayed on structural concrete ceiling located in quarters in sector D.

c. Rolled linoleum located in quarters' bathrooms in sector D.

**1.3.2 The Contractor shall remove the following mechanical asbestos containing material from Sector D:**

a. Thermal system insulation on vertical hot water tanks (called "steam fired domestic water heater" on mechanical drawings) located in two first floor mechanical rooms. The tanks are being removed as a part of this contract. The Contractor has the option of removing the insulation before or after the tank removal. See Drawing P-4, Sector D Plumbing Demolition drawing for additional information on removal of water tanks.

b. The Contractor shall remove a two linear feet portion of asbestos containing thermal system insulation on two pipes in the boiler room so the pipes can be cut as a part of the mechanical renovations in this contract. Pipe is canvas jacketed with 2" to 3-1/2" outside diameter. See Sector D plumbing and HVAC demolition drawings for pipes and locations to be cut.

**1.3.3 The work covered by this section includes the handling of friable and Category I nonfriable asbestos-containing materials (ACM) which are encountered during repair, construction and demolition projects and describes procedures and equipment required to protect workers and occupants of the work area from contact with airborne asbestos fibers and ACM dust and debris. The work also includes the disposal of the generated ACM wastes. More specific operational procedures shall be outlined in the required Asbestos Hazard Abatement Plan called for elsewhere in this specification. The specific ACM to be abated is identified on the detailed plans and project drawings. A summary of each individual ACM abatement work task is included in TABLE 1, "Summary of Asbestos Abatement Work Tasks". The required RESPONSE ACTION DETAIL and SET-UP DETAIL SHEETS for each work task are appended to TABLE 1, herein. This abatement work is governed by 40 CFR 763.**

#### **1.4 ADDITIVE ALTERNATES**

a. Additive alternates 1 and 2 include all mechanical and architectural asbestos abatement within sector D as shown on the contract drawings and as detailed in TABLE 1.

b. Additive alternate 3 includes all mechanical asbestos abatement within sector D and architectural asbestos abatement in 10 units within sector D as shown on the contract drawings and as detailed in TABLE 1.

c. Additive alternate 4 includes all mechanical asbestos abatement within sector D and architectural asbestos abatement in 4 units within sector D as shown on the contract drawings and as detailed in TABLE 1.

## **1.5 SECURITY**

The Contractor shall provide security for each asbestos regulated work area. A log book shall be kept documenting entry into and out of the asbestos regulated work area. Entry into asbestos regulated work areas shall only be by personnel authorized by the Contractor and Contracting Officer's Representative. Personnel authorized to enter asbestos regulated work areas shall be trained, medically evaluated and wear the personal protective equipment, as required by this specification, for the specific asbestos regulated work area to be entered.

## **1.6 MEDICAL REQUIREMENTS**

Medical requirements shall conform to 29 CFR 1926, Section 1926.58.

### **1.6.1 Medical Examinations**

Before being exposed to airborne asbestos fibers, workers shall be provided with a comprehensive medical examination as required by 29 CFR 1926, Section 1926.58 and other pertinent state or local requirements. This requirement must have been satisfied within the past year. The same medical examination shall be given on an annual basis to employees engaged in an occupation involving asbestos and within 30 calendar days before or after the termination of employment in such occupation. X-ray films of asbestos workers shall be identified to the consulting radiologist and medical record jackets shall be marked with the word "asbestos."

### **1.6.2 Medical and Exposure Records**

Complete and accurate records shall be maintained of each employee's medical examinations, medical records and exposure data as required by 29 CFR 1910, Section 1910.20 and 29 CFR 1926, Section 1926.58 for a period of 30 years after termination of employment. Records of the required medical examinations and exposure data shall be made available for inspection and copying to: The Assistant Secretary of Labor for Occupational Safety and Health (OSHA) or authorized representatives of the employee and an employee's physician upon request of the employee or former employee. Maintain on file at the work site for review as requested by the Contracting Officer's Representative, a copy of the required medical certification for each employee.

## **1.7 TRAINING**

Within 1 year prior to assignment and commencement of work on this asbestos abatement project, each worker directly involved in handling ACM, ACM generated wastes to include packaging and transporting such wastes for disposal, shall take and successfully complete a course of asbestos training as specified by United States Environmental Protection Agency (EPA) requirements at 40 CFR 763, Subpart E, Appendix C. Workers shall take and successfully complete the "Worker" course. Onsite supervisors and technical support personnel shall take and successfully complete the "Contractor/Supervisor" course. Worker and Contractor/Supervisor courses taken more than 1 year prior to commencement of work are acceptable provided that the

individual has successfully completed the annual refresher training as required by the regulatory agency. In addition, prior to the commencement of work, each worker shall be instructed by the Contractor's industrial hygienist and onsite "competent person" supervisor in the following project specific training: the hazards and health effects of the specific types of ACM to be abated, the content and requirements of the Contractor's Asbestos Hazard Abatement Plan, Accident Prevention Plan, Hazard Communication Program, Site Safety and Health Plan, work practices, the use requirements and limitations of the personal protective clothing, and equipment to be used, hands-on-training for each asbestos abatement technique to be employed, heat and/or cold stress monitoring specific to this project, personal hygiene and housekeeping requirements, air monitoring program and procedures, medical surveillance to include medical and exposure record keeping procedures, the association of cigarette smoke and asbestos-related disease, security procedures, emergency response requirements and all additional requirements of 29 CFR 1926, Section 1926.58. Training shall also include, for each employee, a respirator fit test administered by the Contractor's Industrial Hygienist as required by 29 CFR 1926, Section 1926.58.

#### **1.8 RESPIRATORY PROTECTION PROGRAM**

The Contractor's Industrial Hygienist shall establish in writing, and implement a respiratory protection program in accordance with 29 CFR 1926, Section 1926.58, 29 CFR 1910, Section 1910.134, ANSI Z88.2, CGA G-7 and CGA G-7.1. DETAIL SHEET NO. 12 entitled "Respiratory Protection Table" is appended herein and shall be used by the Contractor's Industrial Hygienist to establish minimum respiratory protection requirements based on measured or anticipated levels of airborne asbestos fiber concentrations encountered during the performance of the asbestos abatement work. The Contractor's respiratory protection program shall include, but not be limited to, the following elements:

- a. The company policy, used for the assignment of individual responsibility, accountability, and implementation of the respiratory protection program.
- b. The standard operating procedures covering the selection and use of respirators. Respiratory selection shall be determined by the hazard to which the worker is exposed.
- c. Medical evaluation of each user to verify that the worker may be assigned to an activity where respiratory protection is required.
- d. Training in the proper use and limitations of respirators.
- e. Respirator fit-testing, i.e., quantitative, qualitative and individual functional fit checks.
- f. Regular cleaning and disinfection of respirators.
- g. Routine inspection of respirators during cleaning and after each use when designated for emergency use.
- h. Storage of respirators in convenient, clean, and sanitary locations.
- i. Surveillance of work area conditions and degree of employee exposure (e.g., through air monitoring).
- j. Regular evaluation of the continued effectiveness of the respiratory protection program.
- k. Recognition and procedures for the resolution of special problems as they affect respirator use (e.g., no facial hair that comes between the respirator face piece and face or interferes with valve function; prescription eye wear usage; prohibition of wearing contact lenses; etc.).
- l. Proper training in donning and doffing procedures.

#### **1.9 HAZARD COMMUNICATION PROGRAM**

A hazard communication program shall be established and implemented in accordance with 29 CFR 1926, Section 1926.59.

#### **1.10 SAFETY AND HEALTH COMPLIANCE**

In addition to detailed requirements of this specification, the work shall comply with applicable laws, ordinances, criteria, rules, and regulations of Federal, state, regional, and local authorities regarding handling, storing, transporting, and disposing of asbestos waste materials and with the applicable requirements of 29 CFR 1910, 29 CFR 1926, 40 CFR 61, Subpart A, and 40 CFR 61, Subpart M, NFPA 10, NFPA 70, NFPA 90A, NFPA 101. Matters of interpretation of standards shall be submitted to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, rules, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirement as defined by the Contracting Officer's Representative shall apply.

#### **1.11 INDUSTRIAL HYGIENIST (IH)**

Personal and area air sampling and training shall be conducted under the direction of an IH experienced in asbestos abatement and who is currently certified in the comprehensive practice of industrial hygiene by the American Board of Industrial Hygiene (ABIH). For the purpose of this contract, the Contractor shall retain the services of an independent IH to perform clearance sampling.

#### **1.12 PERMITS, LICENSES AND NOTIFICATIONS**

Necessary permits and licenses shall be obtained in conjunction with the project asbestos abatement, transportation and disposal actions and timely notification furnished of such actions required by Federal, state, regional, and local authorities and as otherwise specified herein. The Contractor shall notify the state's environmental protection agency responsible for asbestos air emissions and the Contracting Officer's Representative in writing at least 10 days prior to the commencement of work in accordance with 40 CFR 61, Subpart M, state and local requirements to include the mandatory "Notification of Demolition and Renovation Record" form and other required notification documents.

#### **1.13 SUBMITTALS**

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL PROCEDURES:

SD-01 Data

Materials and Equipment; FIO; CD

Manufacturer's catalog data for all materials and equipment to be used in the work, including brand name, model, capacity, performance characteristics and any other pertinent information. Test results and certificates from the manufacturer of encapsulants substantiating compliance with performance requirements of these specifications. Material Safety Data Sheets for all chemicals to be used onsite in the same format as implemented in the Contractor's HAZARD COMMUNICATION PROGRAM.

- a. High efficiency filtered local exhaust equipment
- b. Vacuum equipment
- c. Pressure differential monitor
- d. Air monitoring equipment

- e. Respirators
- f. Personal protective clothing and equipment
  - (1) Coveralls
  - (2) Underclothing
  - (3) Other work clothing
  - (4) Foot coverings
  - (5) Hard hats
  - (6) Eye protection
  - (7) Other items required and approved by Contractor's IH
- g. Duct Tape
- h. Disposal Containers
  - (1) Disposal bags
  - (2) Fiberboard drums
  - (3) Paperboard boxes
- i. Sheet Plastic
  - (1) Polyethylene Sheet - General
  - (2) Polyethylene Sheet - Flame Resistant
  - (3) Polyethylene Sheet - Reinforced
- j. Wetting Agent
  - (1) Amended Water
  - (2) Removal encapsulant
- k. Strippable Coating
- l. Prefabricated Decontamination Unit(s)
- m. Other items
- n. Chemical encapsulant
- o. Chemical encasement materials
- p. Material Safety Data Sheets (for all chemicals proposed)

#### Safety Plan; GA; CD

A written Safety and Occupational Health Program (SHP) and a comprehensive site-specific Accident Prevention Plan (APP) at least 30 days prior to start of work. The APP shall include the submission during the project, of Activity Hazard Analyses for each major phase of work. The required respiratory protection and hazard communication program shall be incorporated into the APP. This plan must be accepted in writing by the Contracting Officer's Representative prior to start of any site work.

#### Asbestos Hazard Abatement Plan; GA; CD

A detailed plan of the response actions to be taken (ACM items to be abated and method of abatement for each abatement work task - see each RESPONSE ACTION DETAIL SHEET) and the control procedures (containment techniques to include safety precautions and work procedures; See SET-UP DETAIL SHEETS) to be used in the abatement of the ACM. The plan shall take into consideration all the individual ACM abatement work tasks as summarized in paragraph DESCRIPTION OF WORK and TABLE 1. The plan shall be prepared by, signed and sealed including certification number and dated by the Contractor's IH. Such plan shall include, but not be limited to the precise personal protective equipment to be used, the location of asbestos regulated work areas including clean and dirty areas, access tunnels, decontamination unit (clean room, shower room, equipment room, storage areas such as load-out unit), abatement method, interface of trades involved in the construction, sequencing of asbestos related work, disposal procedures and plan, type of wetting agent and asbestos encapsulant to be used, location of local exhaust equipment, planned air monitoring strategies, and a detailed description of the method to be employed in order to control the spread of ACM wastes and airborne fiber concentrations. The plan shall also include both fire and medical emergency response procedures and the specific security procedures to be used for all



asbestos regulated work areas. The asbestos hazard abatement plan shall be submitted at least 30 days prior to start of work. This plan must be accepted in writing prior to the start of any asbestos abatement work.

#### SD-04 Drawings

Site Layout; GA; CD

Descriptions, detail project drawings, site layout to include work site containment area techniques as prescribed on SET-UP DETAIL SHEETS, local exhaust ventilation system locations, decontamination and load-out units, other temporary waste storage facility, access tunnels, location of temporary utilities electrical, water, sewer and boundaries of each asbestos regulated work area.

#### SD-08 Statements

Qualification; GA; CD

A written qualifications and organization report providing evidence of qualifications of the Contractor, Contractor's onsite supervisor (competent person), Contractor workers, all subcontractors (to include disposal transportation and disposal facility firms), subcontractor supervisors, subcontractor workers, independent IH firm, independent testing laboratory, and testing laboratory analysts, to perform asbestos abatement activities as required herein. The report shall specify the Contractor's staff organization to include subcontractors, independent IH firm and testing laboratory chain of command to be used for this project. The report shall be signed by the Contractor and the principals of all subcontractor, independent IH and testing laboratory firms and certify that all firms and personnel involved in the asbestos abatement project fully understand the contents of 29 CFR 1926, 40 CFR 61, Subparts M, and the Federal, state and local requirements specified in paragraph SAFETY AND HEALTH COMPLIANCE. The Contractor's qualification report shall contain information required below:

a. Evidence that Contractor's full-time onsite supervisor is designated as, and is qualified to be a "competent person" in accordance with 29 CFR 1926 and is experienced in the administration and supervision of asbestos abatement projects, including work practices, abatement methods, protective measures for personnel, inspection of asbestos abatement work areas, evaluating the integrity of containment barriers, placement and operation of local exhaust systems, ACM generated waste containment and disposal procedures, decontamination units installation and maintenance requirements, site safety and health requirements, etc. This designated "competent person" onsite supervisor shall be responsible for compliance with applicable Federal, state and local requirements, the Contractor's SHP and APP and the Asbestos Hazard Abatement Plan. The Contractor shall submit evidence that this person has a minimum of 2 years of on-the-job asbestos abatement supervisory experience.

b. The name, address and telephone number of each independent testing laboratory selected to perform the sample analyses and report the results. The testing laboratory shall be completely independent from the Contractor as recognized by Federal, state or local regulations. For each laboratory selected to conduct phase contrast microscopy (PCM) of airborne samples using the methods specified by 29 CFR 1926 and NIOSH Pub No. 84-100 Method 7400; transmission electron microscopy (TEM) of airborne samples using the methods specified by NIOSH Pub No. 84-100 Method 7402 (TEM confirmation of asbestos content of PCM results), written verification of the following criteria, signed by the Testing Laboratory principal and the Contractor shall be submitted:

(1) The laboratory is currently judged proficient in counting airborne asbestos samples by PCM by successful participation within the past year in the American Industrial Hygiene Association (AIHA) Proficiency Analytical Testing (PAT) Program.

(2) The laboratory is fully equipped and each analyst possesses demonstrated proficiency to confirm NIOSH Pub No. 84-100 Method 7400 PCM sample analyses results from the same filter by conducting NIOSH Pub No. 84-100 Method 7402 TEM analyses.

(3) The laboratory is fully equipped to conduct polarized light microscopy (PLM) analysis of suspect ACM bulk samples in accordance with 40 CFR 61, Subpart M and the laboratory is currently accredited by the National Institute for Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP) for bulk asbestos analysis and will use analysts with demonstrated proficiency to conduct PLM to include its application to the identification and quantification of asbestos content.

#### Designated Industrial Hygienist Qualifications; GA; CD

The name, address, telephone number, and resume of the Industrial Hygienist (IH) selected to prepare the Contractor's Asbestos Hazard Abatement Plan, prepare and perform training, direct air monitoring and assist the Contractor's competent person supervisor in implementing and ensuring safety and health requirements are complied with during the performance of all required work. The IH shall be a person who is board certified in the comprehensive or specialized practice of industrial hygiene as determined and documented by the American Board of Industrial Hygiene (ABIH), and has a minimum of 2 years of comprehensive experience in planning and overseeing asbestos abatement activities. The IH shall be completely independent from the Contractor and shall not be an employee of the Contractor or be an employee or principal of a firm recognized by Federal, state, or local regulations that would constitute a business relationship that would not be considered independent. A copy of the IH's current valid ABIH Certification current valid ABIH confirmation of eligibility in writing from the ABIH shall be included. In addition, the designated IH shall prepare and the Contractor shall submit the name, address, telephone numbers and resumes of additional IH's and industrial hygiene technicians (IHT) who will be assisting the designated IH in performing onsite tasks. IHs and IHTs supporting the designated IH shall have a minimum of 2 full years of practical onsite asbestos abatement experience. The formal reporting relationship between the designated IH and the support IHs and IHTs, the Contractor's competent person, and the Contractor shall be indicated. The resume of each designated IH shall be signed by the designated IH and Contractor. The resume of each designated IH's support IH and IHT staff shall be signed by the individual for whom the resume was prepared and the designated IH.

#### Landfill and Transporter Qualifications; GA; CD

Written evidence that the landfill for disposal is approved for asbestos disposal by the USEPA and state regulatory agencies. Copies of signed agreements between the Contractor, and each subcontractor to include transporters and the asbestos waste disposal facility to accept and dispose of all asbestos containing waste generated during the performance of this contract. Qualification resumes of each subcontractor transporter to be used, indicating previous experience in transport and disposal of asbestos waste to include all required state and local waste hauler requirements for asbestos.

#### Employee Training and Certification of Worker Acknowledgment; GA; CD

The following training documentation for each employee to be engaged in the abatement work who will be potentially exposed to asbestos as determined by their direct handling of the material, entrance into an asbestos regulated work area, or airborne exposure in excess of 0.005 f/cc measured as an 8-hour time-weighted average:

- a. Copy of certification of accreditation for completion of "workers" course (for workers) or "Contractor/Supervisor" Course (for Contractors and onsite supervisory staff) meeting the requirements of EPA's 40 CFR 763 or more stringent state criteria, and all subsequent annual refresher training certificates meeting same requirements.

- b. A copy of a Contractor generated form entitled Certificate of Workers Acknowledgment shall be completed for each employee in the same format and containing the same information as the example certificate appended to this section.

#### Training Material; FIO; CD

A copy of the written project site-specific training material as indicated in 29 CFR 1926, Section 1926.58 that will be used to train all on-site employees.

This training document shall be signed by the Contractor's IH and competent person supervisor.

#### Certification of Medical Requirements; GA; CD

For each worker, a written medical opinion prepared and signed by a licensed physician indicating the following:

- a. Summary of the results of the examination.
- b. The potential for an existing physiological condition that would place the employee at an increased risk of health impairment from exposure to asbestos.
- c. The ability of the individual to wear personal protective equipment including respirators while performing strenuous work tasks under cold stress and/or heat stress conditions.
- d. A statement that the employee has been informed of the results of the examination, been provided a copy of the results, and informed of any medical condition that may result from asbestos exposure.

#### Encapsulants; GA; CD

Certificates stating that encapsulants meet the applicable specified performance requirements.

#### SD-09 Reports

#### Field Tests; FIO; CD

- a. Air sampling reports.
- b. Pressure differential recording local exhaust system.
- c. Asbestos disposal waste disposal record report.

#### Air Sampling Results; GA; CD

Air sample fiber counting shall be completed and results provided within 24 hours after completion of a sampling period. The Contracting Officer's Representative shall be notified immediately of any airborne levels of asbestos fibers in excess of established requirements. Written sampling results shall be provided within 5 working days of the date of collection. The written results shall be signed by testing laboratory analyst, testing

laboratory principal, the Contractor's IH and the Contractor. The air sampling results shall be documented on a Contractor's daily air monitoring log. The daily air monitoring log shall contain the following information for each sample: date sample collected, date sample analyzed, sample number, sample type (P = Personal, A = Area, C = Abatement Clearance, IRWA = Inside regulated work area, ORWA = Outside regulated work area, DU = Decontamination Unit, LOU = Load-out unit, AT = Access Tunnel), sample period (start time, stop time, elapsed time (minutes), sampling pump manufacturer - model and serial number, average flow rate (liters per minute (L/min)), total air volume sampled (liters (L)), sample results (fibers per cubic centimeter (f/cc)), and location/activity/name where sample collected. In addition, the daily log shall identify the calibration method used to calibrate the sampling pumps, the name and location of the laboratory conducting the sample analyses, print name, signature, and date block for the industrial hygienist who conducted the sampling and the review verifying the accuracy of the information.

#### Pressure Differential Recordings; FIO; CD

Pressure differential recordings shall be provided daily on the same day collected. Readings shall be reviewed by the Contractor's competent person supervisor and/or IH prior to submittal. Contracting Officer's Representative shall be notified immediately of any variance in the pressure differential which could cause adjacent unsealed areas to have asbestos fiber concentrations in excess of 0.005 fiber per cubic centimeter (f/cc) or background, whichever is higher.

#### Notifications; GA; CD

Contracting Officer's Representative shall be notified in writing 10 days prior to the start of asbestos work. A copy of the written notification shall be provided to any rental company concerning the intended use of rental equipment and the possibility of asbestos contamination, the decontamination procedures that will be used prior to the return of the equipment. A copy of the rental company's written acknowledgment and agreement shall be included in the submittal.

#### SD-13 Certificates

##### Vacuum, Filtration and Ventilation Equipment; FIO; CD

Manufacturer's certifications showing compliance with ANSI Z9.2 for:

- a. Vacuums.
- b. Water filtration equipment.
- c. Ventilation equipment.
- d. Other equipment required to contain airborne asbestos fibers.

#### SD-18 Records

##### Respirator Program; GA; CD

Records of the respirator program as required by ANSI Z88.2, 29 CFR 1910, Section 1910.134, 29 CFR 1926, Section 1926.58.

##### Asbestos Waste Shipment; GA; CD

Final completed copies of the Waste Shipment Record for all shipments of waste material as specified in 40 CFR 61, Subpart M including EPA form 8700-22 with Stephen Kauffman, Eglin AFB Environmental Manager, signing as generator. Mr Kauffman can be reached at (904)882-6282, Ext 253 and at AFDTC/EMCW, 501 DeLeon St. Suite 101, Eglin AFB, FL 32542-5133. Detailed information of all

asbestos waste disposals on the "MANDATORY WASTE SHIPMENT RECORD" form in accordance with revised 40 CFR 61, Subpart M. Such completed forms signed and dated by the agent of the landfill shall be submitted within 3 days after date of delivery of ACM to the landfill.

#### **1.14 PERSONAL PROTECTIVE EQUIPMENT**

Contractor workers shall be provided with personal protective clothing and equipment as specified herein and the Contractor shall ensure that it is worn properly. The Contractor's Industrial Hygienist and designated competent person supervisor shall select and approve all the required personal protective clothing and equipment to be used. Three complete sets of personal protective equipment shall be made available to the Contracting Officer's Representative and authorized visitors for entry to the asbestos regulated work area at all times for inspection of the asbestos regulated work area. Contracting Officer's Representative and authorized visitors shall be provided with training equivalent to that provided to Contractor employees in the selection, fitting, and use of the required personal protective equipment and the site safety and health requirements.

##### **1.14.1 Respirators**

Respirators shall be selected and used in accordance with manufacturers recommendations, and shall be approved by the Mine Safety and Health Administration and the National Institute for Occupational Safety and Health (MSHA/NIOSH) for use in environments containing airborne asbestos fibers. Personnel who handle ACM, enter asbestos regulated work areas that require the wearing of a respirator, or who are otherwise carrying out abatement activities that require the wearing of a respirator, shall be provided with approved respirators that are fully protective of the worker at the measured or anticipated airborne asbestos concentration level to be encountered. For air-purifying respirators, the particulate filter portion of the cartridges or canister approved for use in airborne asbestos environments shall be Type H, high-efficiency particulate air (HEPA). As a minimum a half-mask air-purifying respirator shall be worn during the startup of abatement activities, unless otherwise approved in writing by the Contracting Officer's Representative. The upgrading or downgrading of respirator type, from the minimum requirements specified for start-up, shall be made by the Contractor's IH based on the measured or anticipated airborne asbestos fiber concentrations to be encountered. All recommendations made by the Contractor's IH to downgrade respirator type shall be submitted in writing to the Contracting Officer's Representative for acceptance. Contractor's IH actions to upgrade respirator type shall be verbally conveyed to the Contracting Officer's Representative. Respiratory protection shall comply with the 29 CFR 1926, and 29 CFR 1910. A qualitative or quantitative fit test conforming to 29 CFR 1926, Appendix C shall be conducted by the Contractor's IH for each Contractor worker required to wear a respirator, and for the Contracting Officer's Representative and authorized visitors who enter an asbestos regulated work area where respirators are required to be worn. A respirator fit test shall be performed for each worker prior to initially wearing a respirator on this project and every 6 months thereafter. If physical changes in a worker develop that will affect the fit, a new fit test shall be performed. Functional fit checks shall be performed by employees each time a respirator is put on and in accordance with the manufacturer's recommendation.

##### **1.14.2 Whole Body Protection**

Personnel exposed to asbestos shall be provided with whole body protection as specified herein and such protection shall be worn properly. The Contractor's IH and competent person supervisor shall select and approve the whole body protection to be used. Disposable whole body protection shall be disposed of

as asbestos contaminated waste upon exiting from the asbestos regulated work area. Reusable whole body protection worn shall be either disposed of as asbestos contaminated waste upon exiting from the asbestos regulated work area or be properly laundered in accordance with 29 CFR 1926 and as specified in the Contractor's Asbestos Hazard Abatement Plan. Asbestos abatement whole body protection shall not be removed from the work site by a worker to be cleaned.

#### **1.14.2.1 Coveralls**

Disposable - breathable or Reusable coveralls with a zipper front shall be provided. Sleeves shall be secured at the wrists, and foot coverings secured at the ankles. See DETAIL SHEET 13.

#### **1.14.2.2 Gloves**

Disposable plastic or rubber gloves shall be provided to protect hands. Cloth gloves may be worn inside the plastic or rubber gloves for comfort, but shall not be used alone. Where there is the potential for hand injuries (i.e., scrapes, punctures, cuts, etc.) a suitable outer glove shall be provided and used.

#### **1.14.2.3 Under Clothing**

Disposable underwear shall be provided and worn next to the skin or cloth under clothing.

#### **1.14.2.4 Work Clothing**

An additional coverall similar to that required in paragraph Coveralls shall be provided when the abatement and control method employed does not provide for the exit from the asbestos regulated work area directly into an attached decontamination unit. Cloth work clothes shall be provided for wear under the protective coverall and foot coverings when work is being conducted in low temperature conditions. Cloth work clothes shall be either disposed of as asbestos contaminated material or properly laundered in accordance with 29 CFR 1926 and as specified in the Contractor's Asbestos Hazard Abatement Plan.

#### **1.14.2.5 Foot Coverings**

Cloth socks shall be provided and worn next to the skin. If rubber boots are not used, foot wear and disposable foot coverings shall be provided. Rubber boots shall be used in moist or wet areas. Only rubber boots shall be removed from the asbestos regulated work area after being thoroughly decontaminated. All other protective foot covering shall be disposed of as ACM.

#### **1.14.2.6 Head Covering**

Hood type disposable or reusable head covering shall be provided. In addition, protective head gear (hard hats) shall be provided as required. Hard hats shall only be removed from the asbestos regulated work area after being thoroughly decontaminated.

#### **1.14.2.7 Protective Eye Wear**

Contact lenses shall not be worn in asbestos regulated work areas. When vision correction is necessary to perform the work task, prescription safety eye wear shall be used. Fog-proof goggles shall be worn by personnel engaged in asbestos abatement activities in the asbestos regulated work area when the use of a full face-piece respirator is not required. Eye protection provided shall be in accordance with ANSI Z87.1.

#### **1.14.2.8 Other Items**

All other items of whole body protection shall be provided as required and approved by the Contractor's IH.

#### **1.15 DECONTAMINATION UNIT AND LOAD OUT UNIT AND ACCESS TUNNEL**

A temporary negative pressure decontamination, load out unit and access tunnel shall be provided as described in DETAIL SHEET Numbers 22, 23, 20 and 25 appended herein. The decontamination unit shall have a separate equipment locker room and a clean locker room with a shower that complies with 29 CFR 1910, Section 1910.141 in between. Two separate lockers shall be provided for each asbestos worker, one in each locker room. Street clothing and street shoes shall be kept in the clean locker. Upon exiting from the asbestos regulated work area to the equipment room, respirators shall be worn while asbestos contaminated protective clothing is HEPA-vacuumed, removed, and placed in approved labeled containers (see DETAIL SHEETS 9A, 9B, 9C and 14) for disposal and/or laundering. Workers shall shower before changing into street clothes. Used shower water shall be collected and filtered to remove asbestos contamination. Filters and residue shall be disposed of as asbestos contaminated material; see DETAIL SHEETS 9A, 9B, 9C and 14. Filtered water shall be discharged to the sanitary system. Decontamination and load-out unit shall be attached in a leak-tight manner to each asbestos regulated work area.

The Contractor shall provide a minimum 40 gallon electric hot water heater. The waste water pump shall be sized for 1.25 times the showerheads' flow-rate at a pressure head sufficient to satisfy the filter head loss and discharge line losses. The pump shall supply a minimum 25 gallons per minute flow with 35 ft. of pressure head. Waste water filters shall be installed in series with the first stage pore size of 20 microns and the second stage pore size of 5 microns. The floor of the decontamination unit's clean room shall be kept dry and clean at all times. Water from the shower shall not be allowed to wet the floor in the clean room. Surfaces of the clean room and shower shall be wet-wiped 2 times after each shift change with a disinfectant solution. Proper housekeeping and hygiene requirements shall be maintained. Soap and towels shall be provided for showering, washing and drying. Any cloth towels provided shall be disposed of as ACM waste or be laundered in accordance with 29 CFR 1926 and the Contractor's Asbestos Hazard Abatement Plan. Surfaces of the equipment room shall be wet-wiped 2 times after each shift change. Surfaces of the Load-Out-Unit and access tunnel shall be adequately wet-wiped 2 times after each shift change. Materials used for wet wiping shall be disposed of as asbestos contaminated waste.

#### **1.16 WARNING SIGNS AND TAPE**

Contractor shall ensure that all personnel understand the warning signs. Warning signs and tape printed in English shall be provided at the regulated boundaries and entrances to asbestos regulated work areas. Signs shall be located at such a distance that personnel may read the sign and take the necessary protective steps required before entering the area. Warning signs as shown and described in DETAIL SHEET 11 appended herein shall be in vertical format conforming to 29 CFR 1910, and 29 CFR 1926, minimum 20 by 14 inches and displaying the following legend in the lower panel:

Legend	Lettering
Danger	3 inch Sans Serif Gothic or Block
Asbestos	1 inch Sans Serif Gothic or Block
Cancer and Lung Disease Hazard	1 inch Sans Serif Gothic or Block

Authorized Personnel Only	1 inch Sans Serif Gothic or Block
Authorized Personnel Only	1 inch Gothic
Respirators and Protective Clothing are Required in this Area	1 inch Gothic

Spacing between lines shall be at least equal to the height of the upper of any two lines. Warning tape shall be provided as shown and described on DETAIL SHEET 11, appended herein. Decontamination unit signage shall be as shown and described on DETAIL SHEET 15, appended herein.

#### **1.17 WARNING LABELS**

Warning labels shall be affixed to all asbestos disposal containers used to contain asbestos materials, scrap, waste debris, and other products contaminated with asbestos. Containers with preprinted warning labels conforming to requirements specified herein are acceptable. Warning labels shall be as described in DETAIL SHEET 14 appended herein, shall conform to 29 CFR 1926 and shall be of sufficient size to be clearly legible displaying the following legend:

DANGER  
CONTAINS ASBESTOS FIBERS  
AVOID CREATING DUST  
CANCER AND LUNG DISEASE  
HAZARD

#### **1.18 LOCAL EXHAUST SYSTEM**

A local exhaust system shall be provided in the asbestos regulated work area as described in DETAIL SHEET 8, appended herein and in accordance with ANSI Z9.2 and 29 CFR 1926. The system will provide at least 4 air changes per hour inside of the containment. The local exhaust system shall be operated 24 hours per day, until the asbestos regulated containment area is removed and shall be leak proof to the filter and equipped with HEPA filters. Local exhaust equipment shall be sufficient to maintain a minimum pressure differential of minus 0.02 inch of water column relative to adjacent, unsealed areas. Pressure differential shall be monitored continuously, 24 hours per day, with an automatic recording instrument. In no case shall the building ventilation system be used as the local exhaust system for the asbestos regulated work area. Filters on local exhaust system equipment shall conform to ANSI Z9.2 and UL 586. Filter shall be UL labeled. The local exhaust system shall terminate out of doors. All filters used shall be new at the beginning of the project and shall be periodically changed as necessary and disposed of as ACM waste.

#### **1.19 TOOLS**

Vacuums shall be leak proof to the filter, equipped with HEPA filters, be of sufficient capacity and provide the necessary capture velocity at the nozzle or nozzle attachment to efficiently collect, transport and retain the ACM waste material. Power tools shall not be used to remove ACM unless the tool is equipped with effective, integral HEPA filtered exhaust ventilation capture and collection system or has otherwise been approved for use by the Contracting Officer's Representative. All residual asbestos shall be removed from reusable tools prior to storage and reuse. Reusable tools shall be thoroughly decontaminated prior to being removed from asbestos regulated work areas.



## **1.20 RENTAL EQUIPMENT**

If rental equipment is to be used, written notification shall be provided to the rental agency, concerning the intended use of the equipment, the possibility of asbestos contamination of the equipment and the steps that will be taken to decontaminate such equipment. A written acceptance of the terms of the Contractor's notification shall be obtained from the rental agency.

## **1.21 AIR MONITORING EQUIPMENT**

The Contractor's IH shall select and approve the air monitoring equipment to be provided and used by the Contractor for evaluation of airborne asbestos fiber concentrations. The equipment shall include, but not be limited to:

- a. High-volume sampling pumps that can be calibrated and operated at a constant airflow up to approximately 10 liters per minute when equipped with a sampling train of tubing and filter cassette,

- b. Low-volume, battery powered, body-attachable, portable personal pumps that can be calibrated to a constant airflow up to approximately 3.5 liters per minute when equipped with a sampling train of tubing and filter cassette, and a self-contained rechargeable power pack capable of sustaining the calibrated flow rate for a minimum of 10 hours. The pumps shall also be equipped with an automatic flow control unit which shall maintain a constant flow even as filter resistance increases due to accumulation of fiber and debris on the filter surface,

- c. Standard 25 millimeter diameter, 0.8 micron pore size, mixed cellulose ester membrane filters and cassettes with nonconductive barrels and shrink bands, to be used with low flow pumps in accordance with 29 CFR 1926, for personal air sampling,

- d. Standard 25 millimeter diameter, 0.45 micron pore size, mixed cellulose ester membrane filters and cassettes with non-conductive barrels and shrink bands, to be used with high flow pumps when conducting environmental area sampling using NIOSH Pub No. 84-100 Methods 7400 and 7402 and the transmission electric microscopy method specified at 40 CFR 763,

- e. Appropriate plastic tubing to connect the air sampling pump to the selected filter cassette,

- f. A flow calibrator capable of calibration to within plus or minus 2 percent of reading over a temperature range of minus 4 degrees Fahrenheit to plus 140 degrees Fahrenheit and traceable to a National Institute for Standards and Technology (NIST) primary standard.

## **1.22 EXPENDABLE SUPPLIES**

### **1.22.1 Duct Tape**

Industrial grade duct tape shall be provided in 2 inch and 3 inch widths and shall be suitable for bonding sheet plastic and disposal containers specified herein.

### **1.22.2 Disposal Containers**

Leak-tight disposal containers shall be provided for ACM generated wastes as described in DETAIL SHEETS 9A, 9B, 9C and 14 and as specified herein. Leak-tight means that solids, liquids or dust cannot escape or spill out. All disposal containers shall be either pre-labeled or affixed with OSHA warning label as specified in 29 CFR 1926.

### **1.22.3 Disposal Bags**

Six-mil thick leak-tight pre-labeled (OSHA warning label) bags shall be provided for placement of asbestos generated waste as described in DETAIL SHEET 9A.

### **1.22.4 Leak-tight Wrapping**

Two layers of 6 mil (minimum) thick polyethylene sheet stock shall be used for the containment of removed asbestos-containing components or materials such as reactor vessels, large tanks, boilers, insulated pipe segments and other materials too large to be placed in disposal bags as described in DETAIL SHEET 9B. Upon placement of the ACM component or material, each layer shall be individually leak-tight sealed with duct tape.

### **1.22.5 Fiberboard Drums**

Fiberboard drums shall be provided if required by state or local requirements.

### **1.22.6 Cardboard Boxes**

Heavy-duty corrugated cardboard boxes coated with plastic or wax to retard deterioration from moisture shall be provided as described in DETAIL SHEET 9C if required by state and local requirements. Boxes shall fit into selected ACM disposal bags. Filled boxes shall be sealed leak-tight with duct tape.

### **1.22.7 Sheet Plastic**

Sheet plastic shall be provided as specified herein and in the largest sheet size necessary to minimize seams, as indicated on the project drawings.

#### **1.22.7.1 Polyethylene Sheet - General**

Six-mil (minimum) thick polyethylene film shall be clear and conform to ASTM D 4397.

#### **1.22.7.2 Polyethylene Sheet - Flame Resistant**

Where a potential for fire exists, 6 mil (minimum) thick flame-resistant polyethylene sheet shall be provided. Flame-resistant polyethylene film shall be frosted and shall conform to the requirements of NFPA 701.

#### **1.22.7.3 Polyethylene Sheet-Reinforced**

Six-mil thick reinforced polyethylene sheet shall be provided where high skin strength is required such as where it constitutes the only barrier between the asbestos regulated work area and the outdoor environment. The sheet stock shall consist of translucent, nylon-reinforced or woven-polyethylene thread laminated between two layers of polyethylene film. Film shall meet flame resistant standards of NFPA 701.

#### **1.22.7.4 Viewing Inspection Window**

Where feasible, a minimum of one clear 1/8 inch thick acrylic sheet, 18 inches by 24 inches, shall be installed as a viewing inspection window at eye level on a wall in each containment enclosure. All such windows shall be sealed leak-tight with industrial grade duct tape.

### **1.22.8 Wetting Agents**

#### **1.22.8.1 Amended Water**

Amended water shall meet the requirements of ASTM D 1331.

#### **1.22.8.2 Removal Encapsulant**

Removal encapsulant (a penetrating encapsulant) shall be provided when conducting removal abatement activities that require a longer removal time or are subject to rapid evaporation of amended water. The removal encapsulant shall be capable of wetting the ACM and retarding fiber release during disturbance of the ACM equal to or greater than provided by amended water. Performance requirements for penetrating encapsulants are specified in paragraph ENCAPSULANTS.

### **1.22.9 Strippable Coating**

Strippable coating in aerosol cans shall be used to adhere to surfaces and to be removed cleanly by stripping at the completion of work. Since these coatings have a hydrocarbon carrying agent, their use shall be confined to well ventilated areas.

### **1.23 MATERIAL SAFETY DATA SHEETS**

Material safety data sheets (MSDSs) shall be provided for all hazardous materials brought onto the work-site. One copy shall be provided to the Contracting Officer's onsite Representative and one copy shall be included in the Contractor's Hazard Communication Program.

### **1.24 OTHER ITEMS**

A sufficient quantity of other items shall be provided that may include, but not be limited to: scrapers, brushes, brooms, staple guns, tarpaulins, shovels, rubber squeegees, dust pans, other tools, scaffolding, staging, enclosed chutes, wooden ladders, lumber necessary for the construction of asbestos regulated containment work areas, UL approved temporary electrical equipment, material and chords, ground fault circuit interrupters, water hoses of sufficient length, fire extinguishers, first aid kits, portable toilets, logbooks, log forms, markers with indelible ink, spray paint in bright color to mark areas, project boundary fencing, etc.

### **1.25 PRECONSTRUCTION CONFERENCE**

The Contractor, the Contractor's designated onsite "competent person," supervisor and Contractor's IH shall meet with the Contracting Officer's Representative prior to beginning work at a safety preconstruction conference to discuss the details of the Contractor's Asbestos Hazard Abatement Plan, SHP and APP including work procedures and safety precautions. Once accepted by the Contracting Officer's Representative, the Asbestos Hazard Abatement Plan, the SHP and APP will be enforced as if an addition to the specification. Any changes required in the specification as a result of the Asbestos Hazard Abatement Plan shall be identified specifically in the plan to allow for free discussion and acceptance by the Contracting Officer's Representative prior to the start of work.

## **PART 2 PRODUCTS**

### **2.1 ENCAPSULANTS**

Encapsulants shall conform to USEPA requirements, shall contain no toxic or hazardous substances and no solvent and shall meet the following requirements:

<u>Requirement</u>	<u>ALL ENCAPSULANT</u>	<u>Test Standard</u>
Flame Spread - 25, Smoke Emission - 50	ASTM E 84	
Combustion Toxicity Zero Mortality	University of Pittsburgh Protocol	
Life Expectancy - 20 years	ASTM C 732	
	Accelerated Aging Test	
Permeability - Minimum 0.4 perms	ASTM E 96	

<u>Requirement</u>	<u>Additional Requirements for Bridging Encapsulant</u>	<u>Test Standard</u>
Cohesion/Adhesion Test - 50 pounds of force/square foot	ASTM E 736	
Fire Resistance - Negligible affect on fire resistance rating over 3 hour test	ASTM E 119	
Classified by UL for use over fibrous and cementitious sprayed fireproofing)		
Impact Resistance - Minimum 43 in/lb	ASTM D 2794	
	Gardner Impact Test	
Flexibility - no rupture or cracking	ASTM D 522	
	Mandrel Bend Test	

<u>Requirement</u>	<u>Additional Requirement for Lock-Down Encapsulant</u>	<u>Test Standard</u>
Fire Resistance - Negligible affect on fire resistance rating over 3 hour test (Tested with fireproofing over encapsulant applied directly to steel member)	ASTM E 119	
Bond Strength; 100 pounds, force/foot (Tests compatibility with cementitious and fibrous fireproofing)	ASTM E 736	

## **PART 3 EXECUTION**

### **3.1 GENERAL**

Asbestos abatement work tasks as shown on the detailed plans and drawings as summarized in paragraph DESCRIPTION OF WORK and TABLE 1, shall be performed as specified herein to include the appended Asbestos Abatement DETAIL SHEETS.

Personnel shall wear and utilize protective clothing and equipment as specified herein. Eating, smoking, drinking, or applying cosmetics shall not be permitted in the asbestos regulated work area. All hot work (burning, cutting, welding, etc.) shall be conducted under strictly controlled conditions in conformance with 29 CFR 1926. Personnel of other trades not engaged in asbestos abatement activities shall not be exposed at any time to airborne concentrations of asbestos unless all the administrative and personal protective provisions as required herein are complied with. The building heating, ventilating, and air conditioning system shall be shut down, openings to the system capped, and temporary heating and ventilation and air conditioning provided prior to the commencement of abatement work. Electrical service shall be disconnected where necessary for wet removal. Temporary electrical service shall be provided where needed. If an asbestos spill occurs outside of the asbestos regulated work area, work shall be stopped and the Contracting Officer's Representative shall be notified. The condition shall be corrected to the satisfaction of the Contracting Officer's Representative including air sampling, prior to resumption of work. The Contractor shall stop abatement work in the asbestos regulated work area immediately when the measured airborne total fiber concentrations, as sampled and analyzed as required herein, (1) equals or exceeds 0.01 f/cc or the preabatement concentration, whichever is greater, - outside the asbestos regulated work area, or (2) equals or exceeds 1.0 f/cc inside the asbestos regulated work area. The Contractor shall correct the condition to the satisfaction of the Contracting Officer's Representative, including visual inspection and air sampling. Work resumption will only be allowed upon notification by the Contracting Officer's Representative. Corrective actions shall be documented.

### **3.2 PROTECTION OF ADJACENT WORK OR AREAS TO REMAIN**

Asbestos abatement work shall be performed without damage or contamination of adjacent work or area. Where such work or area is damaged or contaminated as verified by the Contracting Officer's Representative using visual inspection and/or sample analysis, it shall be restored to its original condition or decontaminated by the Contractor at no expense to the Government as deemed appropriate by the Contracting Officer's Representative. This includes inadvertent spill of dirt, dust or debris in which it is reasonable to conclude that asbestos may exist. When these spills occur, work shall stop in all affected areas immediately and the spill shall be cleaned. When satisfactory visual inspection and/or sampling analysis results are obtained and have been evaluated by the Contractor's IH and the Contracting Officer's Representative, work may proceed.

### **3.3 FURNISHINGS**

Furniture and equipment will be removed from the area of work by the Government before asbestos abatement work begins.

### **3.4 BUILDING VENTILATION SYSTEM AND CRITICAL BARRIERS**

Any building ventilating system supplying air into or returning air out of an asbestos regulated work area shall be shut down and isolated by lockable switch or other positive means in accordance with 29 CFR 1910, Section 1910.147, to prevent accidental start-up and isolated by airtight seals to prevent contaminant spread through the system. Air-tight critical barriers shall be installed on all building ventilating openings that supply, or return air from the building ventilation system or serves to exhaust air from the building, that are located inside the asbestos regulated work area. The

critical barriers shall consist of 2 layers of 6 mil polyethylene. Edges to wall, ceiling and floor surfaces shall be sealed with industrial grade duct tape. Critical barriers shall be installed as shown on appended SET-UP DETAIL SHEETS 1 and 3 and as specified herein.

### **3.5 PRECLEANING**

Surfaces shall be cleaned by HEPA vacuum and adequately wet wiped prior to establishment of containment.

### **3.6 ASBESTOS CONTROL AREA REQUIREMENTS**

Regulated containment areas shall be established and maintained for each abatement work task as specified in SET-UP DETAIL SHEETS. Viewing inspection window shall be installed on the wall of the containment enclosure, as specified in paragraph Viewing Inspection Window. The following procedures shall be performed sequentially and each activity shall be completed before proceeding to the next. Various steps may be omitted for an individual containment area when that work is not specified on the drawings.

a. Tools, scaffolding, staging, etc., necessary for the work shall be placed in the area to be isolated prior to erection of work area enclosed containment.

b. Building ventilating systems serving the work area shall be shutdown or isolated.

c. Power to the asbestos regulated work area shall be locked-out by switching off all breakers serving power or lighting to this area in accordance with 29 CFR 1910.

d. Surfaces shall be precleaned as required by paragraph PRECLEANING.

e. Personnel Decontamination Unit shall be installed as specified and shown in SET-UP DETAIL SHEETS 22 and 23. Load-Out unit shall be installed as specified herein and in SET-UP DETAIL SHEET 20.

f. Critical barriers shall be installed as required for building ventilation system.

g. Local exhaust ventilation system shall be installed as specified and shown on DETAIL SHEET 8.

h. Containment area shall be installed as required for each abatement task as specified and shown on the SET-UP DETAIL SHEETS 1 and 3.

### **3.7 CLEAN-UP**

The Contractor shall maintain a clean work area by performing on a daily basis the following housekeeping functions at the end of each shift:

a. Loose ACM shall be prepared for disposal by packaging the waste and removing it from the work area to the load-out area.

b. Work area shall be HEPA vacuumed.

c. Polyethylene in work and high traffic areas shall be inspected and repaired.

d. Containment area shall be wet wiped if air sample results exceed prescribed level.

### **3.8 ASBESTOS HANDLING PROCEDURES**

The Contractor shall employ proper handling procedures in accordance with 29 CFR 1926 and 40 CFR 61, Subpart M and the specification requirements herein. The specific abatement techniques and items identified shall be detailed in the Contractor's Asbestos Hazard Abatement Plan including but not limited to

details of construction materials, equipment, and handling procedures. Following task descriptions include the appended drawings which detail the required abatement handling technique.

### **3.8.1 Removal of ACM From Interior Architectural System**

After completion of all asbestos removal work, surfaces from which asbestos containing materials have been removed shall be wet wiped or sponged clean, or cleaned by some equivalent method to remove all visible residue. Run-off water shall be collected and filtered through the dual filtration system. A first filter shall be provided to remove fibers 20 micrometers and larger and a final filter provided that removes all fibers 5 micrometers and larger. After the gross amounts of asbestos have been removed from every surface, all remaining visible accumulations of asbestos on floors shall be collected using plastic shovels, rubber squeegees, rubber dustpans and HEPA vacuum cleaners as appropriate to maintain the integrity of the containment barrier. When all insulation has been removed, workmen shall use HEPA vacuum cleaners to vacuum every surface. Particular attention shall be paid to those surfaces or locations which could harbor accumulations or residual asbestos dust. The following interior ACM shall be removed:

**Textured Ceiling on Structural Substrate: See Sheet 35**

**Asbestos-Containing Sheet Flooring Adhered to Concrete Floor System by**

**Asbestos-Containing Adhesive: See Sheet 64A**

**Asbestos-Containing Adhesive Adhered to Concrete Floor System: See Sheet 64B**

### **3.8.2 Removal of ACM From Mechanical and Electrical Systems**

Following Mechanical/Electrical components shall be removed:

**Storage Tank Insulation: See Sheet 93**

**OR**

**Asbestos Insulated Hot Water Tank** (see paragraph "Sealing Contaminated Items Designated for Disposal" below): **See Sheet 93**

**Pipe Insulation (Using a Glove bag): See Sheet 87**

**OR**

**Pipe Insulation (Using a Mini Containment Area): See Sheet 89**

Written approval must be obtained from the Contracting Officer's Representative before start of work on tanks. Contracting Officer's Representative will ensure that tanks and boilers have been valved off or shut down and allowed a sufficient amount of time to cool down. Insulation shall be sprayed with a mist of amended water or removal encapsulant. Amended water or removal encapsulant shall be allowed to saturate material to substrate. Bands or wires holding breaching or insulation to equipment shall be cut. Cover jackets shall be slit at seams, and sections removed and hand placed in a 6 mil polyethylene disposable bag. Exposed surfaces shall be continuously sprayed with amended water to minimize airborne dust. Insulation on tanks shall not be allowed to drop to the floor. Residue shall be removed from tank surfaces. A water stream shall be used to dislodge insulation in joints or irregular spaces that cannot be reached with tools. Lagging on piping and insulation on fittings shall be removed. A penetrating encapsulant shall be sprayed on all exposed tank breaching surfaces.

### **3.8.3 Sealing Contaminated Items Designated for Disposal**

**If the Contractor chooses to remove the vertical hot water tanks (steam fired domestic water heaters) with asbestos intact, the tanks shall be coated with**

an asbestos lockdown encapsulant at the demolition site before being removed from the asbestos control area. They need not be vacuumed prior to application of the lock-down encapsulant. The asbestos lockdown encapsulant shall be tinted a contrasting color. It shall be spray applied by airless method. Thoroughness of sealing operation shall be visually gauged by the extent of colored coating on exposed surfaces.

### **3.8.4 Exposed Pipe Insulation Edges**

Asbestos insulation to remain shall have exposed edges contained. Wet and cut the rough ends true and square with sharp tools and then encapsulate the edges with a 1/4 inch thick layer of non-asbestos containing insulating cement troweled to a smooth hard finish. When cement is dry, lag the end with a layer of non-asbestos lagging cloth, overlapping the existing ends by 4 inches.

### **3.9 FINAL CLEANING AND VISUAL INSPECTION**

The abated asbestos regulated work area shall be cleaned by collecting, packing, and storing all gross contamination; see SET-UP DETAIL SHEETS 9A, 9B, 9C, 14 and 20. A final cleaning shall use HEPA vacuum and wet cleaning of all exposed surfaces and equipment in the asbestos regulated work area. Upon completion of the cleaning, the Contractor shall conduct a visual pre-inspection of the cleaned area in preparation for a final inspection before final air clearance monitoring and reclean, as necessary. Upon completion of the final cleaning, the Contractor and the Contracting Officer's Representative shall conduct a final visual inspection of the cleaned work area in accordance with ASTM E 1368 and document the results on the Final Cleaning and Visual Inspection as specified on the SET-UP DETAIL SHEET 19. If the Contracting Officer's Representative rejects the abatement area as not meeting final cleaning requirements, the Contractor shall reclean as necessary and have a follow-on inspection conducted with the Contracting Officer's Representative. Recleaning and follow-up reinspection shall be at the Contractor's expense.

### **3.10 LOCK DOWN**

Prior to removal of plastic barriers and after clean-up of gross contamination and final visual inspection, a post removal (lockdown) encapsulant shall then be spray applied to ceiling, walls, floors, and other surfaces in the removal area. The abatement area shall include but not to be limited to constructed enclosures, barriers, polyethylene sheeting that covers any furnishings, and equipment articles to be discarded, critical barriers, air locks, load out units for bag removal, and onsite constructed decontamination unit.

### **3.11 AIR SAMPLING**

Sampling and analysis of airborne concentration of asbestos fibers shall be performed in accordance with 29 CFR 1926 Section 1926.58, the Contractor's air monitoring plan, and as specified herein. Personal air monitoring samples shall be taken for at least 25 percent of the workers in each shift, or a minimum of two, whichever is greater. Results of the personal samples shall be posted at the job site and made available to the Contracting Officer's Representative as specified herein. The Contractor shall maintain a fiber concentration inside enclosed containment regulated work area equal to or less than 0.1 f/cc expressed as an 8 hour, time-weighted average (TWA) during the conduct of the asbestos abatement. If fiber concentration rises above 0.1 f/cc, work procedures shall be investigated with the Contracting Officer's Representative to determine the cause. At the discretion of the Contracting



Officer's Representative, fiber concentration may exceed 0.1 f/cc but shall not exceed 1.0 f/cc expressed as an 8-hour TWA. The Contractor's workers shall not be exposed to an airborne fiber concentration in excess of 1.0 f/cc, as average over a sampling period of 30 minutes. Should either an environmental concentration of 1.0 f/cc expressed as an 8-hour TWA or a personal excursion concentration of 1.0 f/cc expressed as a 30-minute sample occur inside the contained (enclosure) regulated work area, the Contractor shall stop work immediately, notify the Contracting Officer's Representative, and implement additional engineering controls and work practice controls to reduce airborne fiber levels below prescribed limits in the work area. Work shall not restart until authorized by the Contracting Officer's Representative. Air monitoring results at the 95 percent confidence level shall be calculated as shown in TABLE 2 at the end of this section. The Contractor shall provide an onsite independent testing laboratory with qualified analysts and appropriate equipment to conduct sample analyses of air samples using the methods prescribed in 29 CFR 1926 Section 1926.58 to include NIOSH Pub No. 84-100 Method 7400. Sampling performed in accordance with 29 CFR 1926 Section 1926.58 shall be performed by the Contractor's IH. Sampling performed for environmental and quality control reasons shall be performed by the Contractor's IH. Sampling performed after final clean-up, i.e. final clearance air sampling, shall be performed by the Contractor's IH. Personal sampling required by 29 CFR 1926 Section 1926.58, the NIOSH Pub No. 84-100 Method 7400 shall be used for sampling and Phase Contrast Microscopy (PCM) analysis. For environmental quality control and final air clearance NIOSH Pub No. 84-100 Method 7400 (PCM) with optional confirmation of results by NIOSH Pub No. 84-100 Method 7402 Transmission Electron Microscopy (TEM) shall be used. For environmental and final clearance samples, sampling will be conducted at a sufficient velocity and time to collect a sample volume necessary to establish the limit of detection of the method used at 0.005 f/cc. Asbestos fiber concentration confirmation of the total fiber concentration results of environmental, quality assurance and final air clearance samples, collected and analyzed by NIOSH Pub No. 84-100 Method 7400, may be conducted. Confirmation analysis shall be carried out using transmission electron microscopy in accordance with NIOSH Pub No. 84-100 Method 7402. When such confirmation is conducted, it shall be from the same sample filter used for the NIOSH Pub No. 84-100 Method 7400 PCM analysis. For all Contractor required environmental, quality control or final air clearance monitoring, confirmation of asbestos fiber concentrations, using NIOSH Pub No. 84-100 Method 7402, shall be at the Contractor's expense. Monitoring may be duplicated by the Government at the discretion of the Contracting Officer's Representative. If the air sampling results obtained by the Government are lower than those results obtained by the Contractor, the Government results shall prevail.

### **3.11.1 Sampling Prior to Asbestos Work**

The baseline air sampling shall be established one day prior to the masking and sealing operations for each abatement area site. The background shall be established by performing area sampling in similar but uncontaminated sites in the building. Preabatement NIOSH Pub No. 84-100 Method 7400, PCM air samples shall be collected at a minimum of three locations. These locations are: outside the building, inside the building, but outside the abatement area perimeter and inside each abatement area. One sample shall be collected for every 2000 square feet of floor space. At least two sample locations shall be collected outside the building. The PCM samples shall be analyzed immediately; and if any result in fiber concentration greater than 0.01 f/cc,

asbestos fiber concentration shall be confirmed using NIOSH Pub No. 84-100 Method 7402 (TEM) at Government expense.

#### **3.11.2 Sampling During Asbestos Abatement Work**

The Contractor's IH shall provide personal and area sampling as indicated in 29 CFR 1926 Section 1926.58, state and local requirements, and in accordance with the Contractor's air monitoring plan. Area sampling shall be conducted at least once every shift, close to the work in the containment area, outside the clean room entrance to the containment area, (outside air lock for mini and modified containment areas), inside the clean room (inside the air lock for mini and modified containment areas), outside the load-out unit exit, if used, and at the exhaust discharge point of the local exhaust system. If the sampling outside the containment area shows airborne fiber levels have exceeded background or 0.01 f/cc, whichever is greater, all work shall be stopped immediately, and the Contracting Officer's Representative notified. The condition causing the increase shall be corrected. Work shall not restart until authorized by the Contracting Officer's Representative.

#### **3.11.3 Sampling After Final Clean-Up (Clearance Sampling)**

Prior to conducting final air clearance monitoring, the Contractor and the Contracting Officer's Representative shall conduct a final visual inspection of the Contractor's final cleanup of the abated asbestos regulated work area as specified on SET-UP DETAIL SHEET 19. Final clearance air monitoring shall not begin until acceptance of this final cleaning by the Contracting Officer's Representative. The Contractor's IH will provide area sampling of airborne fibers using aggressive air sampling techniques as defined in the EPA 560/5-85-024 or as otherwise required by Federal or state requirements. The sampling and analytical method used will be NIOSH Pub No. 84-100 Method 7400 (PCM) with optional confirmation of results by NIOSH Pub No. 84-100 Method 7402 (TEM). The final clearance air samples shall be collected and analyzed as indicated in TABLE 3 at the end of this section and NIOSH Pub No. 84-100 Method 7400 (PCM).

##### **3.11.3.1 NIOSH Method**

For PCM sampling and analysis using NIOSH Pub No. 84-100 Method 7400, the fiber concentration inside the abated asbestos regulated work area, for each airborne sample shall be less than 0.01 f/cc. Decontamination of the abated asbestos regulated work area is considered complete when every PCM final clearance sample is below the clearance limit. If any sample result is greater than 0.01 f/cc, the asbestos fiber concentration from that same filter shall be confirmed using NIOSH Pub No. 84-100 Method 7402 (TEM) at Contractor's expense. If any confirmation sample result is greater than 0.01 f/cc then abatement is incomplete and recleaning is required. Upon completion of any required recleaning, resampling with results to meet the above clearance criteria is required.

#### **3.11.4 Air Clearance Failure**

Should clearance sampling results fail to meet the final clean-up requirements, the Contractor shall pay all costs associated with all required recleaning, resampling and analysis until final clean-up requirements are met.

### **3.12 SITE INSPECTION**

While performing asbestos removal work, the Contractor shall be subject to onsite inspection by the Contracting Officer's Representative who may be

assisted by or represented by quality assurance, safety and industrial hygiene personnel. If the work is found to be in violation of this specification, the Contracting Officer's Representative or his representative will issue a stop work order to be in effect immediately and until the violation is resolved. Standby time required to resolve the violation shall be at the Contractor's expense.

### **3.13 CLEAN-UP AND DISPOSAL**

#### **3.13.1 Housekeeping**

Surfaces of the regulated work area shall be kept free of accumulation of asbestos-containing debris. Meticulous attention shall be given to restricting the spread of dust and debris. HEPA filtered vacuum cleaners shall be used. The space shall not be blown down with compressed air. When asbestos removal is complete, all asbestos waste is removed from the work site, and final clean-up is completed, the Contracting Officer's Representative will certify the areas as safe before the warning signs and boundary warning tape can be removed. After final clean-up and acceptable airborne concentrations are attained, but before the HEPA unit is turned off and the containment removed, the Contractor shall remove all pre-filters on the building HVAC system and provide new pre-filters. The Contractor shall dispose of such filters as asbestos contaminated materials. HVAC mechanical, and electrical systems shall be re-established in proper working order. The Contracting Officer's Representative will visually inspect all surfaces within the containment for residual material or accumulated debris. The Contractor shall reclean all areas showing dust or residual materials. The Contracting Officer's Representative shall certify in writing that the area is safe before unrestricted entry is permitted. The Government shall have the option to perform monitoring to certify the areas are safe before entry is permitted.

#### **3.13.2 Title to Materials**

Material resulting from abatement work, except as specified otherwise, shall become the property of the Contractor and shall be disposed of as specified in applicable local, state, and Federal regulations and herein.

#### **3.13.3 Collection and Disposal of Asbestos**

Asbestos waste, asbestos contaminated water, scrap, debris, bags, containers, equipment, and asbestos contaminated clothing, shall be collected and placed in sealed leak-tight, containers (e.g. double 6 mil plastic bags) (see Detail Sheet 9A), sealed 6 mil double wrapped polyethylene sheet (see Detail Sheet 9.B), sealed fiberboard boxes (see sheet 9.C) or other approved containers. Waste within the containers must be wetted in case the container is breached.

A warning and Department of Transportation (DOT) label shall be affixed or preprinted on each bag; see DETAIL SHEET 14. Waste asbestos material shall be disposed of at an EPA, state and local approved asbestos landfill. For temporary storage, sealed impermeable containers shall be stored in asbestos waste load-out unit or in a storage/transportation conveyance (i.e.; dumpster, roll-off waste boxes, etc.) in a manner as accepted by and in an area as assigned by the Contracting Officer's Representative. Procedure for hauling and disposal shall comply with 40 CFR 61, Subpart M, state, regional, and local standards.

#### **3.13.4 Asbestos Waste Shipment Record**

The Contractor shall complete and provide final completed copies of the Waste Shipment Record for all shipments of waste material as specified in 40 CFR 61,

Subpart M including EPA form 8700-22 with Stephen Kauffman, Eglin AFB Environmental Manager, signing as generator. Mr Kauffman can be reached at (904)882-6282, Ext 253 and at AFDTC/EMCW, 501 DeLeon St. Suite 101, Eglin AFB, FL 32542-5133. Detailed information of all other required state waste manifest shipment records within 3 days of delivery to the landfill.

NOTES FOR TABLE 1: (1) Alpha sequence of work tasks (A, B, C, etc.) for each asbestos regulated work area. Each category of friability has a separate task. (2) Specific location of the work (building, floor, area, etc.) (3) Description of material. (4) Technique to be used: Removal = REM; Encapsulation = ENCAP; Encasement = ENCAS; Enclosure = ENCL; Repair = REP. (5) Friability of materials: Friable = FR; Non-friable = NF-1 or NF-2; (number indicates friable category). (6) Form: Interior or Exterior Architectural = IA or EA; Mechanical/Electrical = ME. Condition: Good = G; Fair = F; Poor = P. (7) Quantity of ACM in Linear Feet (ft); square feet (sf); each (ea) (8) Response action sheet specifies the material to be abated and the method to be used. (9) Set-up sheets indicate the containment and control methods to be used in support of the response action.

**TABLE 1 - ADDITIVE ALTERNATES 1 AND 2**

SUMMARY OF WORK TASKS

TASK (1)	Remove Exposed Floor Mastic	Remove Textured Ceiling	Remove Thermal System Insulation from Pipes	Remove Insulation from or Remove Entire Insulated Water Tanks	Remove Linoleum and Mastic
LOCATION (2)	D218,D220,D221, D223,D314,D317 D318,D320,D321, D323,D324,D326	All Sector D Quarters	Boiler Room, D123	D110 & D117	All Sector D Quarters
DESCRIPTION (3)	Black, exposed mastic that remains after previous tile removal	White, bumpy blown/painted on textured structural ceiling coating	Canvas jacketed insulated pipes, 2" and 3-1/2" diameter	Insulated vertical hot water tanks	Brown & White speckled rolled flooring and mastic
TECHNIQUE (4)	REM	REM	REM	REM	REM
FRIABILITY (5)	NF-1	FR	FR	FR	NF-1
FORM (6)	IA	IA	ME	ME	IA
CONDITION	P	G	F	F	G
QUANTITY (7)	2000 SF	13,500 SF	4 LF	1 EA 300 GAL Tank & 1 EA 500 GAL Tank	2500 SF
RESP. SHEET (8)	64B	35	87 OR 89	93	64A
SET-UP SHEET (9)	21	3	7 OR 21	3	21

**TABLE 1 (CONTINUED) - ADDITIVE ALTERNATE 3**

SUMMARY OF WORK TASKS

TASK (1)	Remove Textured Ceiling	Remove Thermal System Insulation from Pipes	Remove Insulation from or Remove Entire Insulated Water Tanks	Remove Linoleum and Mastic
LOCATION (2)	Quarters D1U01,D1U02 D1U03,D1U04,D2U01, D2U02,D2U03,D3U01 D3U02,D3U03	Boiler Room, D123	D110 & D117	Quarters D1U01,D1U02 D1U03,D1U04,D2U01 D2U02,D2U03,D3U01 D3U02,D3U03
DESCRIPTION (3)	White, bumpy blown/painted on textured structural ceiling coating	Canvas jacketed insulated pipes, 2" and 3-1/2" diameter	Insulated vertical hot water tanks	Brown & White speckled rolled flooring and mastic
TECHNIQUE (4)	REM	REM	REM	REM
FRIABILITY (5)	FR	FR	FR	NF-1
FORM (6)	IA	ME	ME	IA
CONDITION	G	F	F	G
QUANTITY (7)	4000 SF	4 LF	1 EA 300 GAL Tank & 1 EA 500 GAL Tank	700 SF
RESP. SHEET (8)	35	87 OR 89	93	64A
SET-UP SHEET (9)	3	7 OR 21	3	21

**TABLE 1 (CONTINUED) - ADDITIVE ALTERNATE 4**

SUMMARY OF WORK TASKS

TASK (1)	Remove Textured Ceiling	Remove Thermal System Insulation from Pipes	Remove Insulation from or Remove Entire Insulated Water Tanks	Remove Linoleum and Mastic
LOCATION (2)	Quarters D1U01,D1U02 D2U01,D3U01	Boiler Room, D123	D110 & D117	Quarters D1U01,D1U02 D2U01,D3U01
DESCRIPTION (3)	White, bumpy blown/painted on textured structural ceiling coating	Canvas jacketed insulated pipes, 2" and 3-1/2" diameter	Insulated vertical hot water tanks	Brown & White speckled rolled flooring and mastic
TECHNIQUE (4)	REM	REM	REM	REM
FRIABILITY (5)	FR	FR	FR	NF-1
FORM (6)	IA	ME	ME	IA
CONDITION	G	F	F	G
QUANTITY (7)	1700 SF	4 LF	1 EA 300 GAL Tank & 1 EA 500 GAL Tank	300 SF
RESP. SHEET (8)	35	87 OR 89	93	64A
SET-UP SHEET (9)	3	7 OR 21	3	21

TABLE 2

FORMULA FOR CALCULATION OF THE 95 PERCENT CONFIDENCE LEVEL  
(Reference: NIOSH 7400)

Fibers/cc (01.95 percent CL) = X + (X) (1.645) (CV)				
Where:	X = ( (E) (AC) ) / ( (V) (1000) )			
	E = ( (F/Nf) - (B/Nb) ) / Af			
	CV = The precision value; 0.45 shall be used unless the analytical laboratory provides the Contracting Officer's Representative with documentation (Round Robin Program participation and results) that the laboratory's precision is better.			
	AC = Effective collection area of the filter in square millimeters			
	V = Air volume sampled in liters			
	E = Fiber density on the filter in fibers per square millimeter			
	F/Nf = Total fiber count per graticule field			
	B/Nb = Mean field blank count per graticule field			
	Af = Graticule field area in square millimeters			

TABLE 3  
NIOSH METHOD 7400  
PCM ENVIRONMENTAL AIR SAMPLING PROTOCOL (NON-PERSONAL)

Sample Location	Minimum No. of Samples	Filter Pore Size (Note 1)	Min. Vol.(Note 2) (Liters)	Sampling Rate (liters/min)
Inside Abatement Area	5/1500 Square Feet (Notes 3 & 4)	0.45 microns	1500	2-10
Each Room in Abatement Area Less than 1500 Square Feet	1	0.45 microns	1500	2-10
Field Blank	2	0.45 microns	0	0
Laboratory Blank	1	0.45 microns	0	0

## Notes:

1. Type of filter is Mixed Cellulose Ester.
2. Ensure detection limit for PCM analysis is established at 0.005 fibers/cc.
3. One sample should be added for each additional 1500 square feet.
4. No less than 5 samples are to be taken per abatement area, plus two field blanks.



CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

PROJECT NAME \_\_\_\_\_ CONTRACT NO. \_\_\_\_\_

PROJECT ADDRESS \_\_\_\_\_

CONTRACTOR'S NAME \_\_\_\_\_

EMPLOYEE'S NAME \_\_\_\_\_

WORKING WITH ASBESTOS CAN BE DANGEROUS. INHALING ASBESTOS FIBERS HAVE BEEN LINKED WITH TYPES OF LUNG DISEASE AND CANCER. IF YOU SMOKE AND INHALE ASBESTOS FIBERS, THE CHANCE THAT YOU WILL DEVELOP LUNG CANCER IS GREATER THAN THAT OF THE NONSMOKING PUBLIC.

Your employer's contract for the above project requires that: you be provided with and complete formal and project specific training, you be supplied with proper personal protective equipment including respirators, that you be trained in its use and that you receive a medical examination to evaluate your physical capacity to perform your assigned work tasks, under the environmental conditions expected, while wearing the required personal protective equipment. These things are to be done at no cost to you. By signing this certification, you are acknowledging that your employer has met these obligations to you.

**Date Completed**

FORMAL TRAINING: I have completed a formal training course for: asbestos abatement workers (for workers) (Contractor/ Supervisor) that meets EPA's and this state's requirements. . . . . \_\_\_\_\_

In addition, I have completed annual refresher as required by EPA and this state's requirements. . . . . \_\_\_\_\_

PROJECT SPECIFIC TRAINING: I have been provided and have completed the project specific training required by this Contract. My employer's industrial hygienist and competent person supervisor conducted the training. . . . . \_\_\_\_\_

RESPIRATORY PROTECTION: I have been trained in accordance with the criteria in the Contractor's Respiratory Protection program. I have been trained in the dangers of handling and breathing asbestos dust and in the proper work procedures and use and limitations of the respirator(s) I will wear. I have been trained in and will abide by the facial hair policy of my employer. . . . . \_\_\_\_\_

RESPIRATOR FIT-TEST TRAINING: I have been trained in the proper selection, fit, use, care, cleaning, and maintenance, and storage of the respirator(s) that I will wear. I have been fit-tested in accordance with the criteria in the Contractor's Respiratory Program and have received a satisfactory fit. I have been assigned my individual respirator. I have been taught how to properly perform positive and negative pressure fit-check upon donning negative pressure respirators each time. . . . . \_\_\_\_\_

CERTIFICATE (Continued)

MEDICAL EXAMINATION: I have had a medical examination within the last twelve months which was paid for by my employer. The examination included: health history, pulmonary function tests, and may have included an evaluation of a chest x-ray. A physician made determination regarding my physical capacity to perform work tasks on the project while wearing personal protective equipment including a respirator. I was personally provided a copy and informed of the results of that examination. My employer's industrial hygienist evaluated the medical certification provided by the physician and checked the appropriate blank below.

The physician determined that there:

\_\_\_\_\_ were no limitations to performing the required work tasks;

\_\_\_\_\_ were identified physical limitations to performing the required work tasks.

Employees Signature \_\_\_\_\_ date \_\_\_\_\_

Printed Name \_\_\_\_\_

Social Security Number \_\_\_\_\_

Contractor's Industrial Hygienist Signature \_\_\_\_\_  
date \_\_\_\_\_

Printed Name \_\_\_\_\_

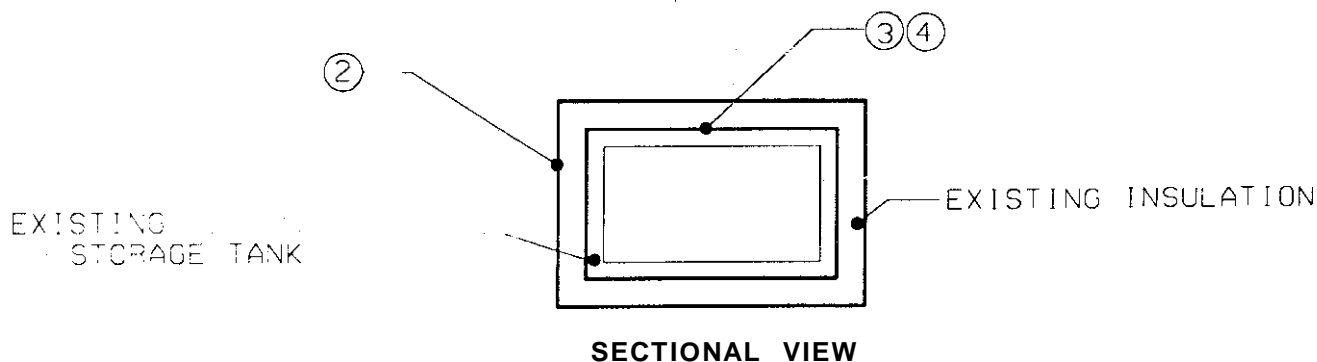
Social Security Number \_\_\_\_\_

Date medical exam completed \_\_\_\_\_

--End of Section--

### Removal of Asbestos Insulated Hot Water Tank

1. Prepare containment area as specified on sheet 3.
2. Remove tank per paragraph "Sealing Contaminated Items Designated for Disposal" in Specification Section 02080.
3. Prepare area for final air clearance.
4. Carry out final clearance requirements specified on sheet 17.

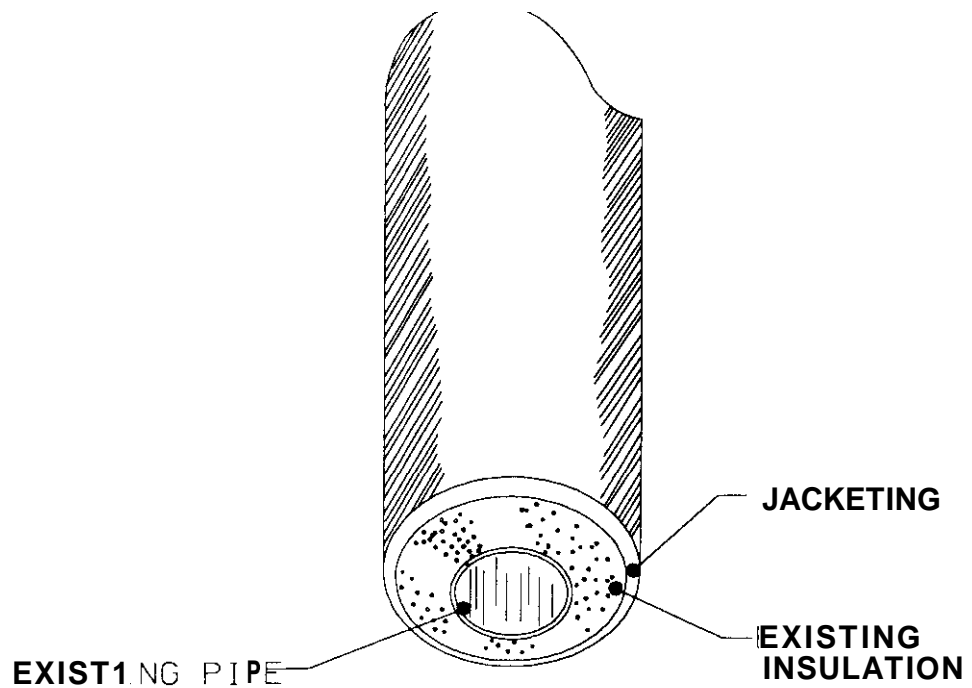


NOTE: For additional requirements see paragraph "Removal of ACM from Mechanical and Electrical Systems" in Specification Section 02080.

### Removal of storage tank

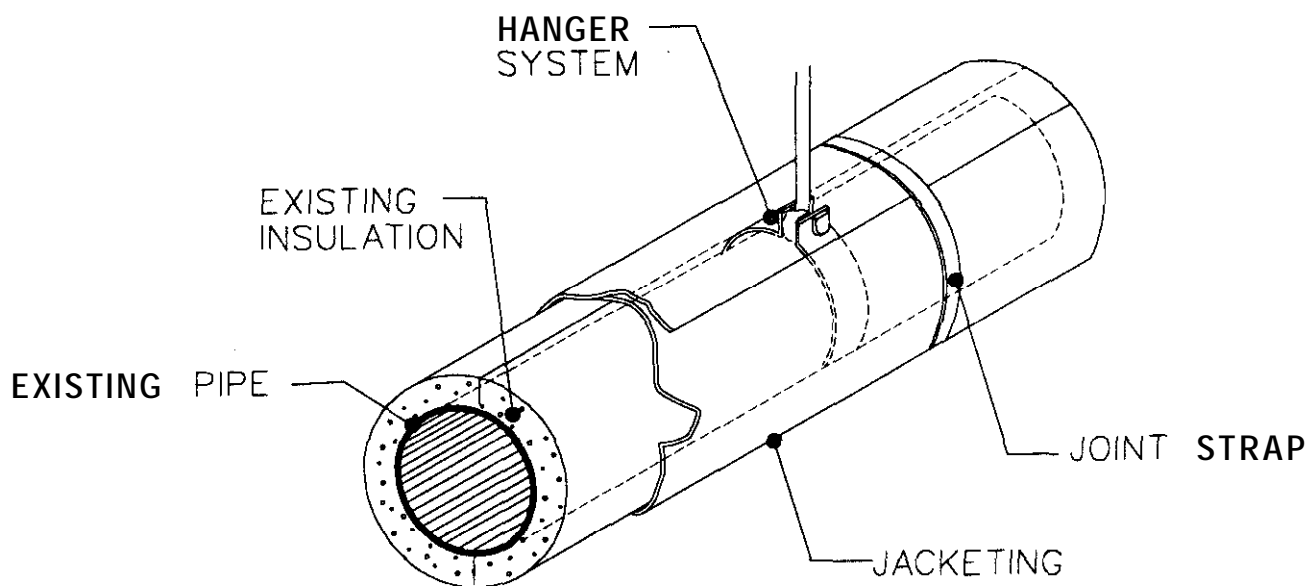
### insulation

- |  |  |
|--|--|
| <ol style="list-style-type: none"> <li>1. Prepare containment areas as specified on sheet 3</li> <li>2. Adequately wet mist surface with amended water. initially and during removal. Remove insulation, including reinforcing fabric, mesh, steel bands or wire, and jacketing. Place in approved containers; see sheet 9. Apply labels; see sheet 14.</li> <li>3. Clean exposed surfaces by spraying with amended water and brushing, HEPA vacuuming, and adequately wet cleaning all surfaces.</li> </ol> | <ol style="list-style-type: none"> <li>4. Inspect and reclean area as necessary</li> <li>5. Spray a tinted penetrating encapsulant. Inspect and reapply as necessary.</li> <li>6. Prepare area for final air clearance.</li> <li>7. <b>Carry out</b> final clearance requirements specified on 17</li> </ol> |
|--|--|



### Removal of pipe insulation (using mini-containment area)

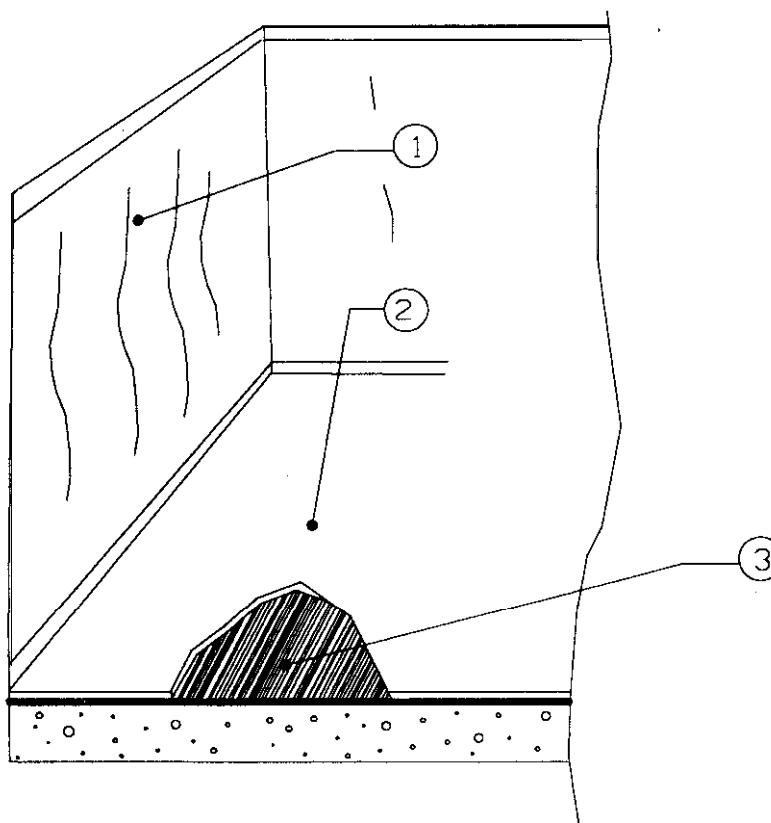
1. Prepare mini-containment area as specified on sheet 7.
2. Adequately wet mist insulation surface with amended water, initially and during removal. Remove jacketing and insulation from pipe and hanger system.
3. Clean exposed surfaces by spraying with amended water and brushing.
4. Inspect and reclean area as necessary.
5. Spray a tinted penetrating encapsulant on pipe and exposed ends of insulation. Inspect and reapply as necessary.
6. Prepare area for final clearance.
7. Carry out final clearance requirements specified on sheet 7.



NOTE: THIS SHEET CAN BE USED FOR  
VERTICAL OR HORIZONTAL PIPING.

### Removal of pipe insulation (using glove bag)

1. **Install glove bag** as specified on sheet 10. Prepare modified containment area as specified on sheet 21. Adequately wet mist insulation surface with amended water, initially and during removal.
2. Remove jacketing and asbestos pipe insulation from pipe and hanger to within 2 inches of inside edges of glove bag.
3. Clean exposed surfaces by spraying with amended water and brushing.
4. Inspect and reclean as necessary.
5. Spray a tinted penetrating encapsulant on pipe and exposed ends of insulation.
6. Inspect piping and reapply encapsulant as necessary.
7. Prepare area for final air clearance.
8. Carry out final clearance requirements specified on sheets 10 and 21.



Asbestos-containing adhesive  
Removal of  $\Delta$  adhered to concrete floor system

1. Prepare containment area as specified on sheet 21  
~~NOTE: Where full containment is required, follow instructions on sheet 4, except omit polyethylene on floor.~~

2. Mist exposed surfaces with amended water ~~before sheet flooring is removed. Remove flooring in manageable pieces and place on two layers of 6-mil polyethylene. Wrap each layer of polyethylene around the stack, sealing all joints and edges with duct tape; see sheet 9. Apply labels; see sheet 14. Place smaller material in approved container; see sheet 9. Apply labels; see sheet 14.~~

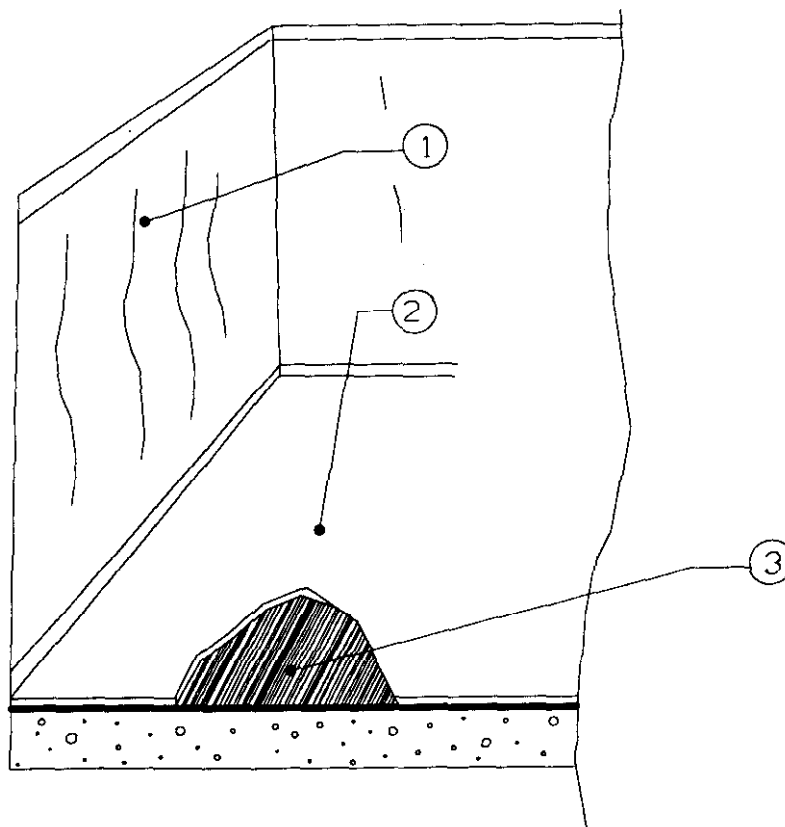
3. ~~Remove remaining adhesive~~ down to bare concrete. Place in approved container; see sheet 9. Apply labels; see sheet 14.

4. Clean, HEPA vacuum, and wet wipe all surfaces.

5. Inspect and reclean area as necessary

6. Prepare area for final air clearance

7. Carry out final clearance requirements specified on applicable sheet 21.



### Removal of sheet-flooring adhered to concrete floor system by asbestos-containing adhesive

1. Prepare containment area as specified on sheet 21.

~~NOTE: Where full containment is required, follow instructions on sheet 4, except omit polyethylene on floor.~~

2. Mist exposed surfaces with amended water just before sheet flooring is removed. Remove flooring in manageable pieces and place on two layers of 6-mil polyethylene. Wrap each layer of polyethylene around the stack, sealing all joints and edges with duct tape; see sheet 9. Apply labels; see sheet 14. Place smaller material in approved container; see sheet 9. Apply labels; see sheet 14.

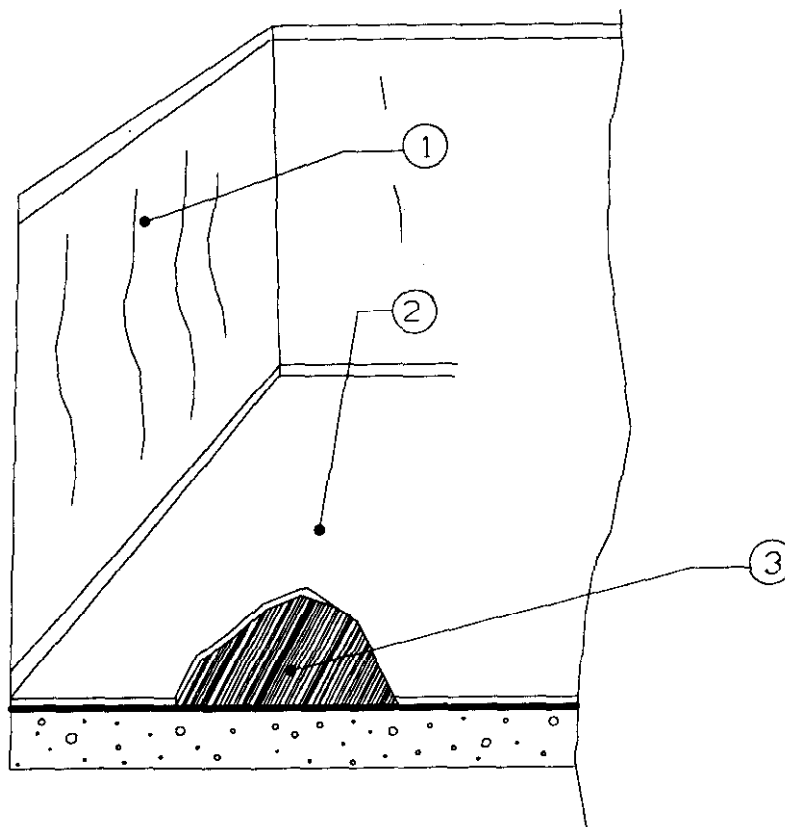
3. Remove remaining adhesive down to bare concrete. Place in approved container; see sheet 9. Apply labels; see sheet 14.

4. Clean, HEPA vacuum, and wet wipe all surfaces.

5. Inspect and reclean area as necessary.

6. Prepare area for final air clearance.

7. Carry out final clearance requirements specified on applicable sheet 21.



### Removal of sheet-flooring adhered to concrete floor system by asbestos-containing adhesive

1. Prepare containment area as specified on sheet 21.

~~NOTE: Where full containment is required, follow instructions on sheet 4, except omit polyethylene on floor.~~

2. Mist exposed surfaces with amended water just before sheet flooring is removed. Remove flooring in manageable pieces and place on two layers of 6-mil polyethylene. Wrap each layer of polyethylene around the stack, sealing all joints and edges with duct tape; see sheet 9. Apply labels; see sheet 14. Place smaller material in approved container; see sheet 9. Apply labels; see sheet 14.

3. Remove remaining adhesive down to bare concrete. Place in approved container; see sheet 9. Apply labels; see sheet 14.

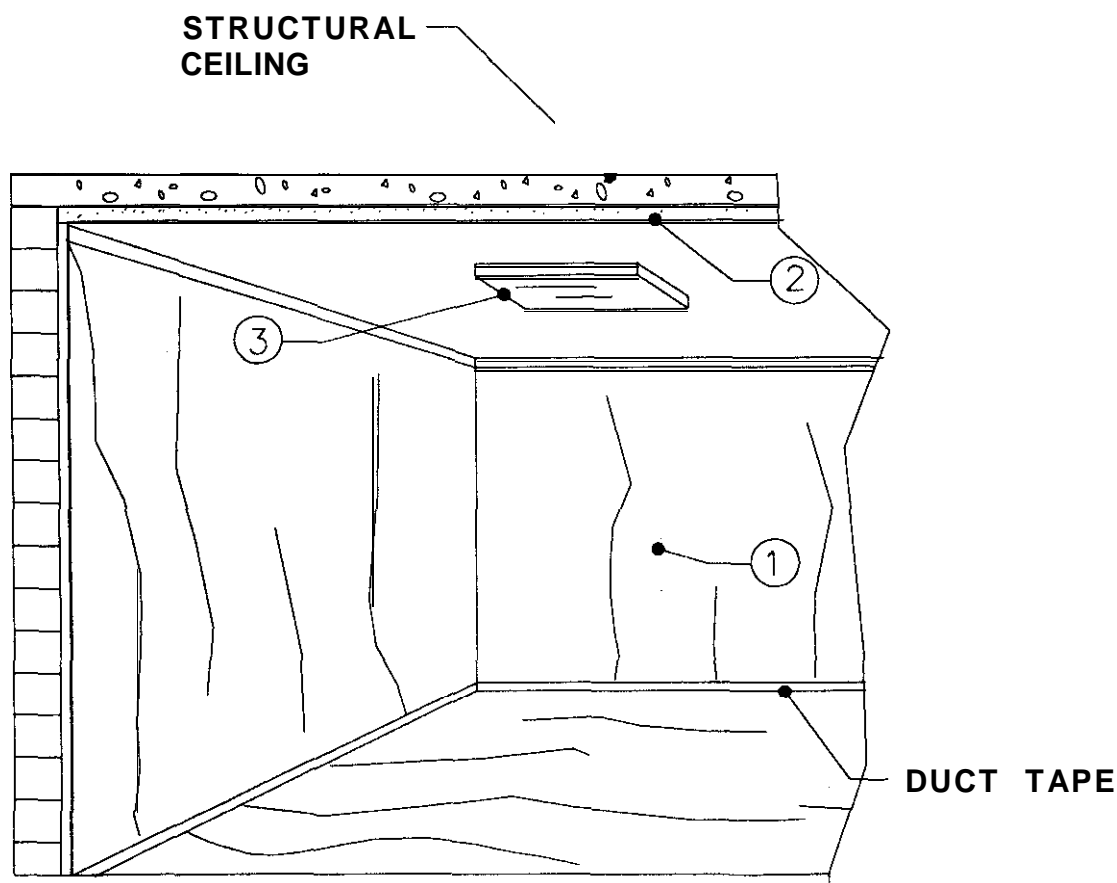
4. Clean, HEPA vacuum, and wet wipe all surfaces.

5. Inspect and reclean area as necessary.

6. Prepare area for final air clearance.

7. Carry out final clearance requirements specified on applicable sheet 21.





### Removal of Textured ceiling

### on structural substrate

1. Prepare containment area as specified on sheet 3.

2. Adequately wet mist surface of textured ceiling with amended water, initially and during removal procedure.

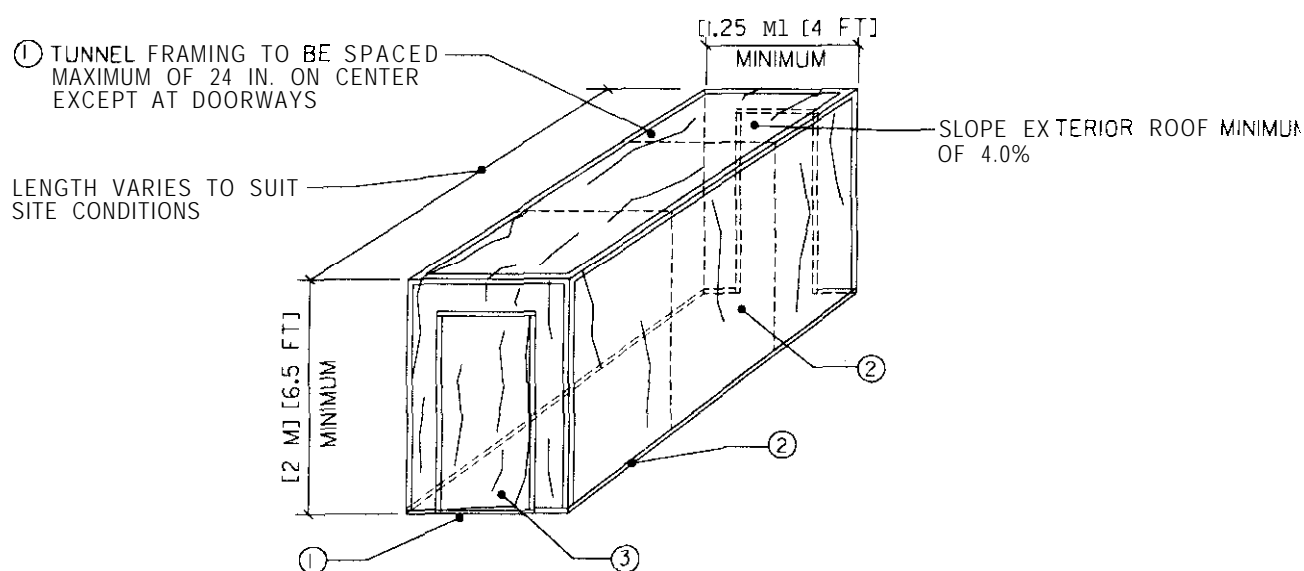
3. Remove all surface-mounted fixtures. Remove plaster on structural substrata. HEPA vacuum and wet wipe surface in order to remove remaining residue. Place removed asbestos-containing material in approved container, and seal leak-tight; see sheet 9. Apply labels; see sheet 14.

4. Inspect and reclean area as necessary.

5. Apply penetrating encapsulant. Tint encapsulant in order to visually verify full coverage. Inspect and reapply encapsulant as necessary.

6. Prepare area for final air clearance.

7. Carry out final clearance requirements as specified in applicable sheet 17.



### Access tunnel

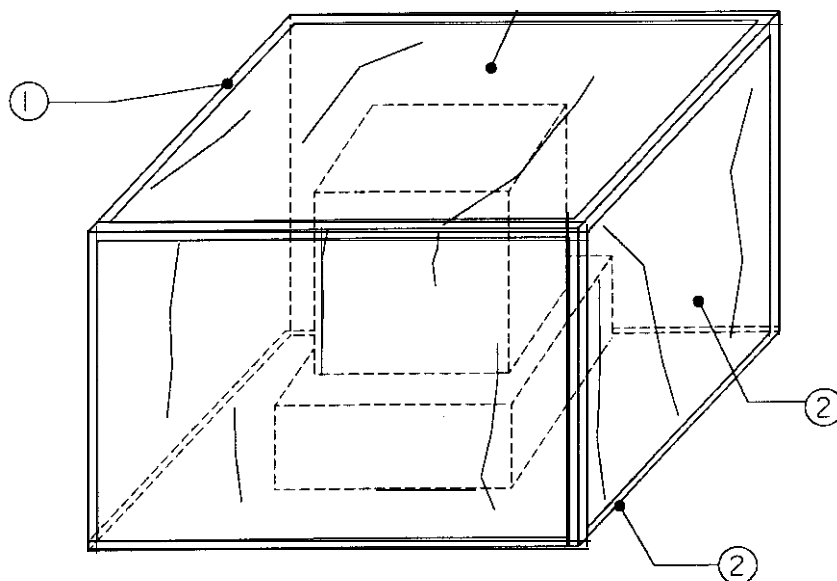
1. Construct a wood frame tunnel; cover all sides and the roof of the frame with polyethylene. NOTE: Cover all sides and roof with plywood or reinforced polyethylene if access tunnel is located outside.

2. Cover entire tunnel with 6-mil polyethylene; seal seams and edges with duct tape, making the tunnel airtight and watertight.

3. Twice daily, or more frequently if necessary, adequately wet clean and HEPA vacuum all wall, floor, and equipment surfaces.

**Final Clearance Requirements.** Upon completion of abatement work, remove access tunnel in accordance with the procedures listed on sheet 16, 17, or 18, and prepare for final clearance.

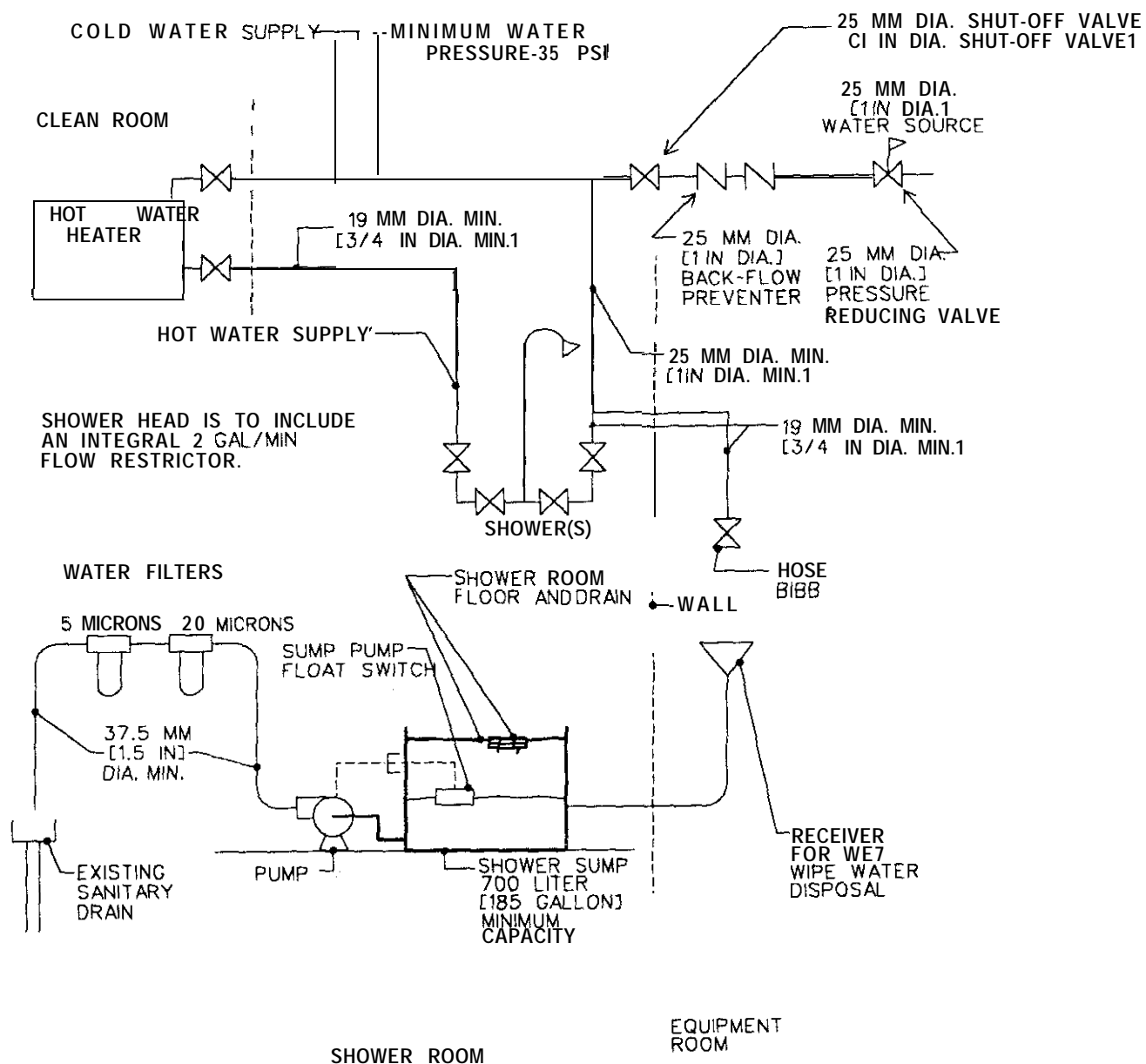
WALL AND SIDE FRAMING MEMBERS  
SHALL BE SPACED MINIMUM OF 24 IN.  
ON CENTER



### Temporary equipment enclosure

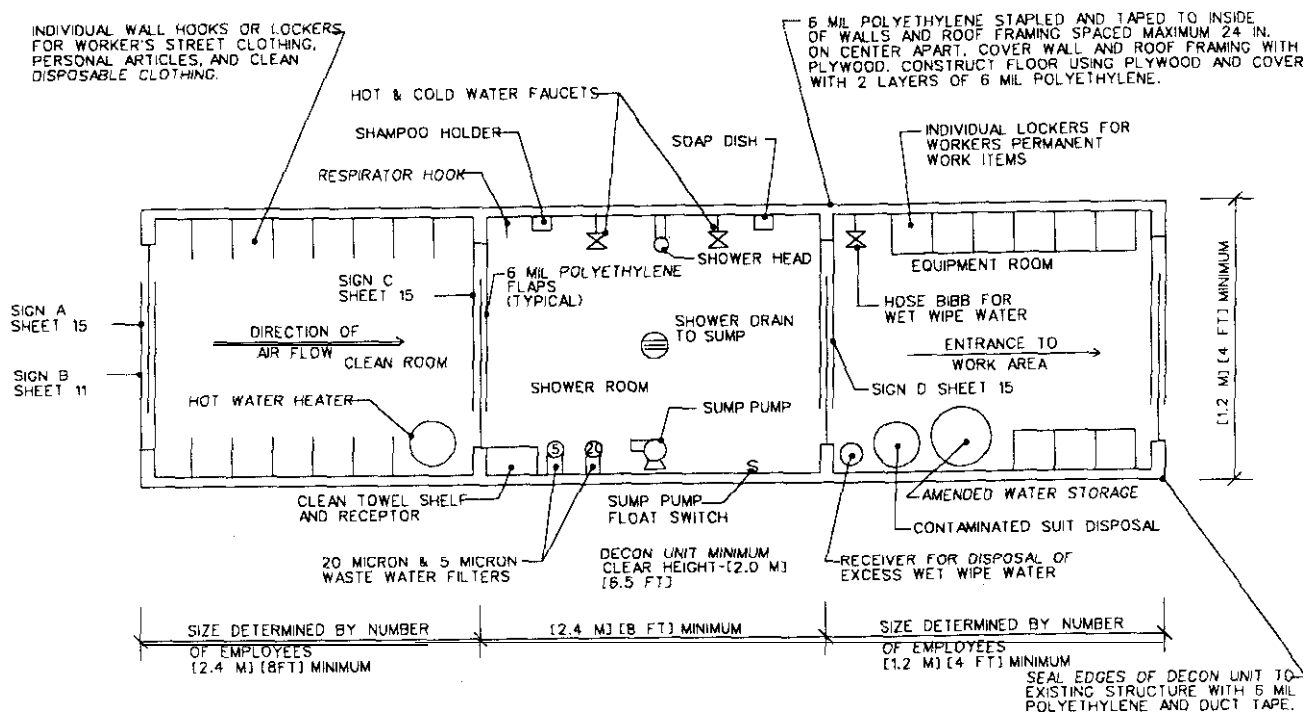
1. Construct wood frame of equipment enclosure; then cover all sides and the roof of frame with plywood.
2. Cover entire plywood equipment enclosure with 6-mil polyethylene. Seal seams and edges with duct tape, making the enclosure airtight and watertight.

**Final clearance requirements.** Upon completion of abatement work, remove temporary enclosure in accordance with the procedures listed on sheet 16, 17, or 18, and prepare for final clearance.



SIZE CAPACITY OF SUMP PUMP FOR TWICE  
THE EXPECTED WASTE WATER FLOW.

### Decontamination unit piping details



Decontamination unit floor plan

1. Establish work area so that unauthorized entry is prevented; see sheets 11 and 15. Before entering the work area, all personnel shall remove their street clothing in the clean room and put on protective clothing and respirator.

2. Whenever exiting the work area, all personnel shall:

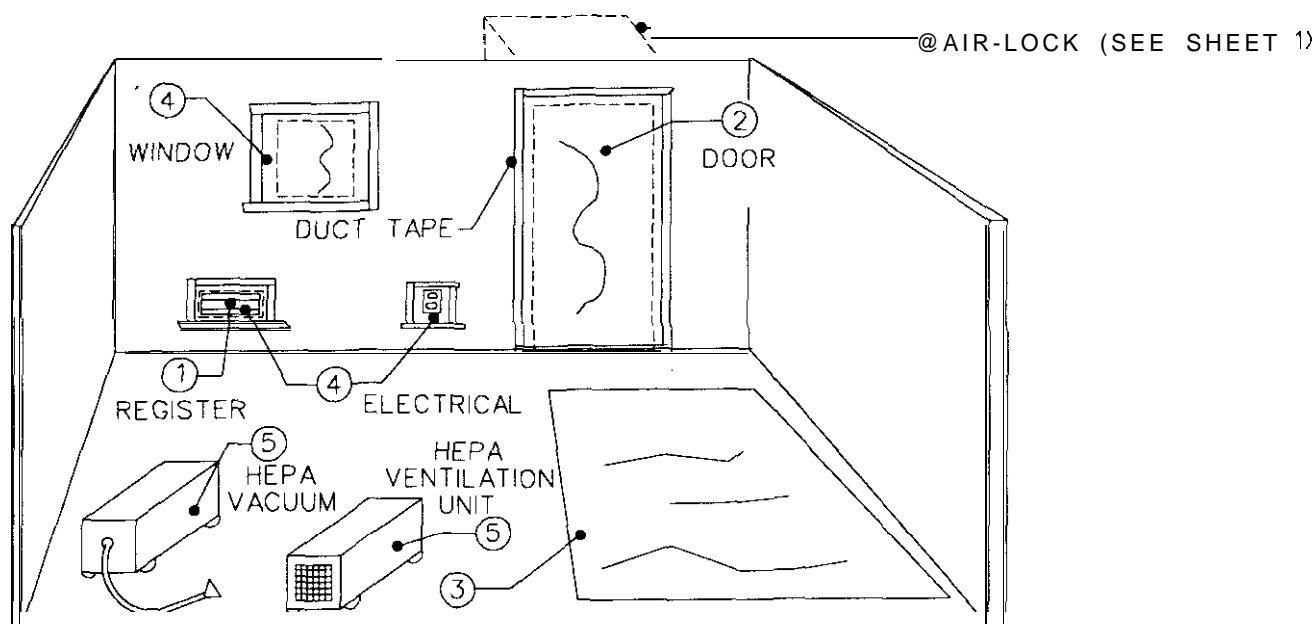
- Vacuum clothing and shoes outside equipment room.
- Remove all clothing and equipment (except respirator) in equipment room.
- Store work shoes and equipment in locker.
- With respirator still on, shower thoroughly, including hair. Then remove respirator and finish shower.
- Proceed to clean room and put on street clothes.

3. See sheet 23 for minimum plumbing requirements, including wastewater filtration. Ensure that plumbing and specified filter size meet local requirements.

4. Twice daily, or more often if necessary, and before breaking down decontamination unit after abatement, adequately wet clean and HEPA vacuum all wall, floor, equipment, and other surfaces. Waste collected in shower room and equipment room shall be treated as asbestos-contaminated material. Place in approved container; see sheet 9. Apply labels; see sheet 14.

5. Prepare for final clearance.

**Final clearance requirements.** Contractor and Contracting Officer will certify visual inspection of work area on sheet 19, *Certification of Final Cleaning and Visual Inspection*. Contract designee(s) will conduct final air-clearance monitoring as required by the contract. If the unit is not a prefabricated decontamination unit, apply lockdown encapsulant before final air-clearance monitoring. After approval of final air clearance, break down and treat polyethylene as asbestos-contaminated material. Place in approved container; see sheet 9. Apply labels; see sheet 14. Dispose of as required by the contract.

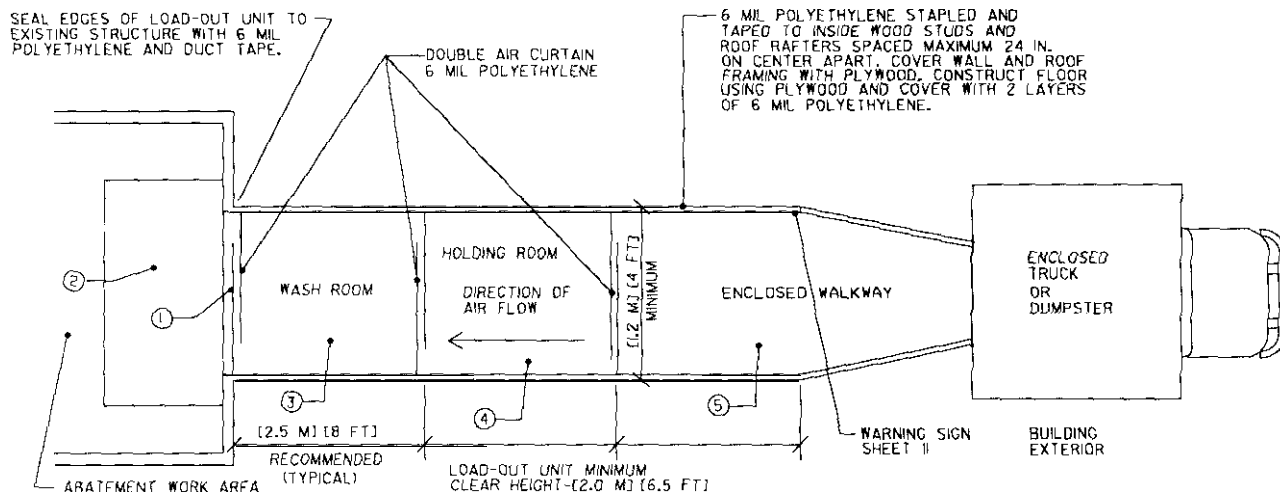


### Modified containment area

1. Establish work area and prevent unauthorized entry; see sheet 11. Eliminate airflow into containment area by isolating all supply and return air ducts from mechanical system.
2. Install air lock at entrance to abatement area; see sheet 1. Air lock may be constructed either outside or inside of room. NOTE: Air lock is not required for glove bag operations.
3. Install 6-mil polyethylene sheet on floor under work area.
4. Install 6-mil polyethylene (critical barrier) over all windows, doors, wall openings, electrical outlets, etc. Provide airtight seal, using duct tape.
5. Provide a HEPA-filter vacuum cleaner and a HEPA-filter ventilation system in the work area; see sheet 6. The ventilation system does not have to be ducted to the outside of the structure. The ventilation system shall operate 24 hours a day from start of abatement through final air-clearance monitoring. The ventilation system shall be sized to recirculate the air a minimum of four air changes per hour. For glove bag operations, provide a single HEPA ventilation "nit with a measured capture velocity at least 1,500 cfm.

6. Accumulate all loose material and polyethylene from floor. Place in approved container; see sheet 9. Apply labels; see sheet 14. HEPA vacuum and adequately wet clean all wall, floor, and equipment surfaces.

**Final clearance requirements.** Abatement worker must wear two disposable suits. Remove outer suit in the work area. Place suit in 6-mil disposal bag; see sheet 9. Enter air lock. In air lock, wet wipe respirator and wash hands with clean water from portable sprayer. Remove respirator and place in clean plastic bag. Proceed to remote shower where inner suit may be removed. Prepare work area and air lock for final clearance. Contractor and Contracting Officer will certify visual inspection of work area on sheet 19, *Certification of Final Cleaning and Visual Inspection*. Contract designee(s) will conduct final air-clearance monitoring as required by the contract. Upon instructions from the Contracting Officer, remove critical barriers and HEPA ventilation units; see sheet 8. Treat polyethylene as asbestos-contaminated material. Place in approved container; see sheet 9. Apply labels; see sheet 14. Dispose of as required by the contract.



### Load-out unit floor plan

1. Abatement worker is to enter and exit abatement work area only through decontamination unit.
2. Place additional 6-mil polyethylene sheeting on top of abatement area floor. Double bag asbestos-contaminated material in this area before removing.
3. Wet wipe bags, equipment, and containers, and take to holding room.
4. Stage clean bags, equipment, and containers in holding room until disposal worker removes them.
5. Disposal workers, wearing full protective clothing and appropriate respirator protection, carry decontaminated bags and containers through enclosed walkway and into enclosed truck or Dumpster.

**Final clearance requirements.** Before breaking down load-out unit, adequately wet clean and HEPA vacuum all surfaces and prepare area for final clearance. Contractor and Contracting Officer will certify visual inspection of work area on sheet 19, *Certification of Final Cleaning and Visual Inspection*. Contractor will apply lockdown encapsulant. Contract designee(s) will conduct final air-clearance monitoring as required by the contract. Breakdown load-out area upon instructions from Contracting Officer. Treat as asbestos-contaminated material. Place in approved container; see sheet 9. Apply labels; see sheet 14. Dispose of as required by the contract.

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### Certification of Final Cleaning And Visual inspection

Individual abatement task as identified in paragraph, Description of Work \_\_\_\_\_

In accordance with the cleaning and decontamination procedures specified in the Contractor's asbestos hazard abatement plan and this contract, the Contractor hereby certifies that he/she has thoroughly visually inspected the decontaminated regulated work area (all surfaces, including pipes, beams, ledges, walls, ceiling, floor, decontamination unit, etc.) in accordance with ASTM E1368, *Standard Practice for Visual Inspection of Asbestos Abatement Projects*, and has found no dust, debris, or asbestos-containing material residue.

BY: (Contractor's signature) \_\_\_\_\_ Date \_\_\_\_\_

Print name and title \_\_\_\_\_

(Contractor's Onsite Supervisor signature) \_\_\_\_\_ Date \_\_\_\_\_

Print name and title \_\_\_\_\_

(Contractor's Industrial Hygienist signature) \_\_\_\_\_ Date \_\_\_\_\_

Print name and title \_\_\_\_\_

### Contracting Officer Acceptance or Rejection

The Contracting Officer hereby determines that the Contractor has performed final cleaning and visual inspection of the decontaminated regulated work area (all surfaces including pipes, beams, ledges, walls, ceiling, floor, decontamination unit, etc.) and by quality assurance inspection, finds the Contractor's final cleaning to be:

☐ Acceptable

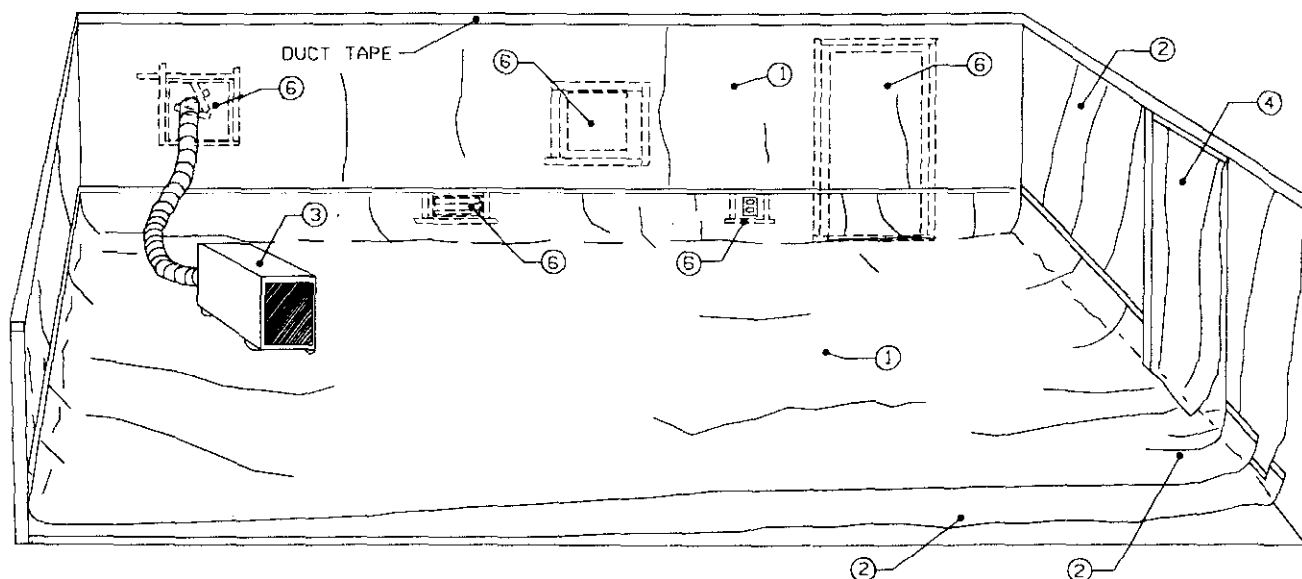
☐ Unacceptable, Contractor instructed to reclean the regulated work area.

BY: Contracting Officer's Representative

Signature \_\_\_\_\_ Date \_\_\_\_\_

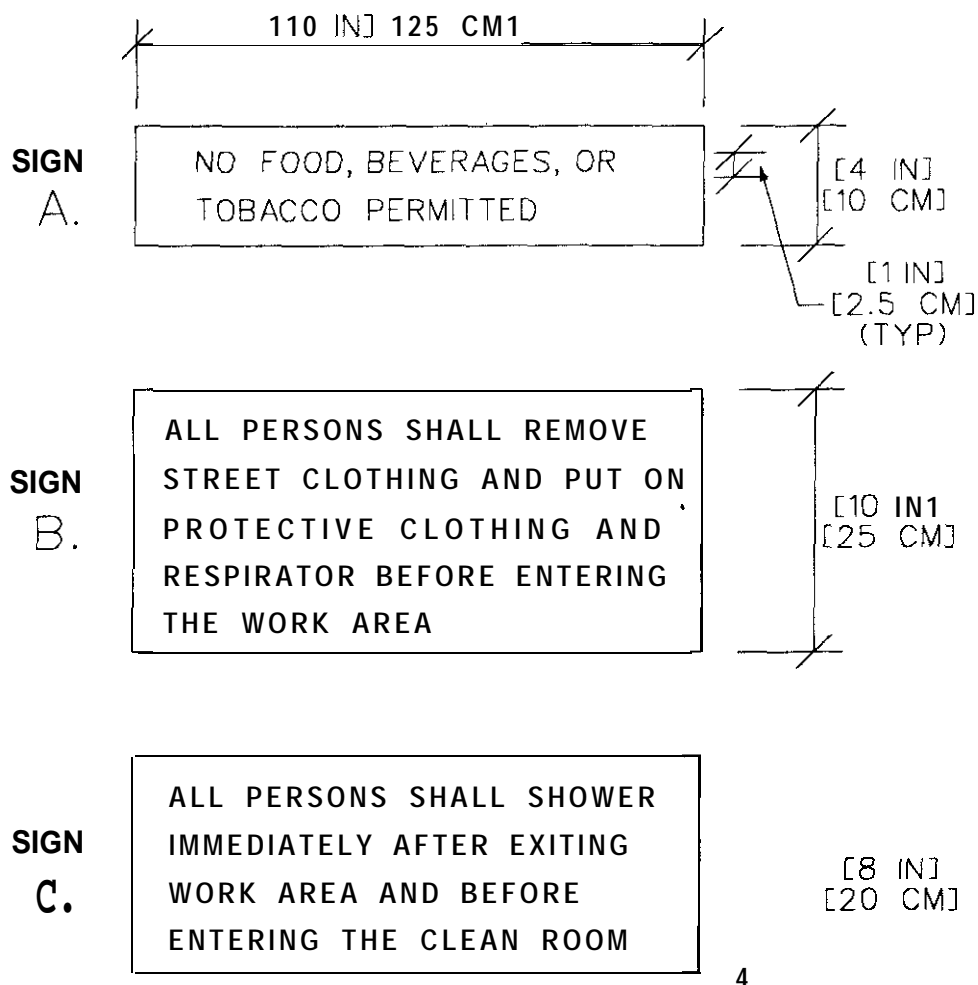
Print name and title \_\_\_\_\_





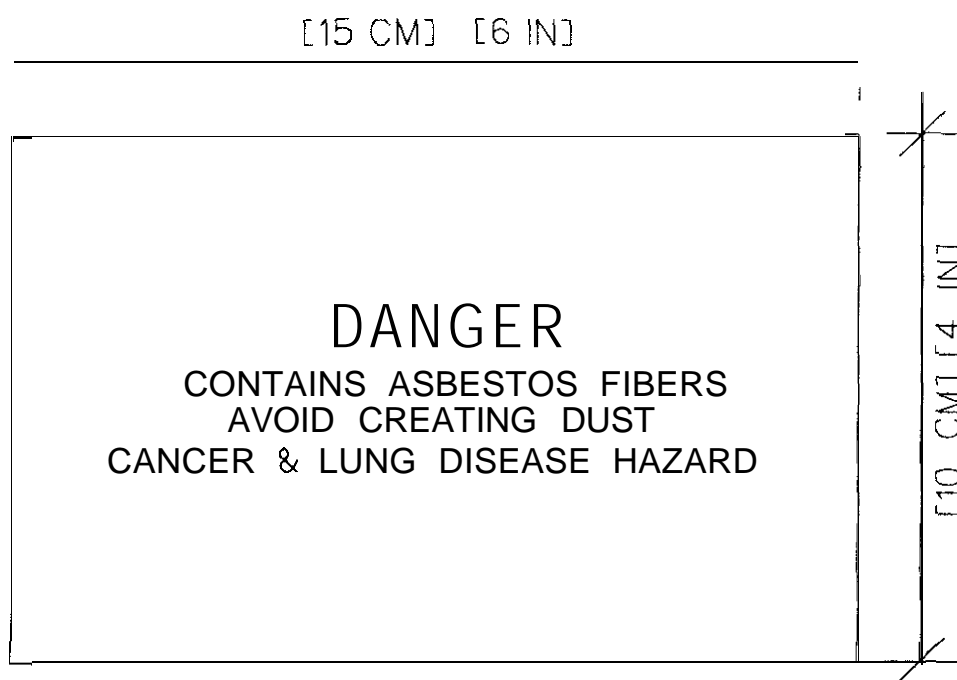
### Preparation of full containment area for final clearance (for hard-surfaced floors)

1. Accumulate all loose material for disposal. Place in approved container; see Sheet 9. Apply labels; see sheet 14. Adequately wet clean and **HEPA** vacuum all wall, floor, and equipment surfaces.
2. Contractor and contracting officer will certify visual inspection of work area on sheet 19, *Certification of final Clearing and Visual Inspection*.
3. Apply **lockdown** encapsulant.
4. Remove polyethylene on walls and floor. Critical barriers sealing all windows, doors, wall openings, electrical outlets, etc., are to remain. Remove any temporary equipment enclosures used; see sheet 24. Treat polyethylene as asbestos-contaminated material. Place in approved container; see sheet 9 for leak-tight wrapping. Apply labels; see sheet 14.
5. **HEPA** filter unit remains in place and operating.
6. Door into decontamination unit or load-out room remains.
7. Prepare area for final clearance.
8. Contractor and Contracting Officer will recertify visual inspection of work area on sheet 19, *Certification of Final Cleaning and Visual Inspection*.
9. Contract **designee(s)** will conduct final air-clearance monitoring as required by the contract.
10. Upon instruction from Contracting Officer, shut down **HEPA** filter ventilation system, detach duct work, move system to equipment room of decontamination unit, clear and dispose of waste; see sheet 8. Remove critical barrier and place in approved container; see sheet 9. Apply labels; see sheet 14. Dispose of waste as asbestos-contaminated material.



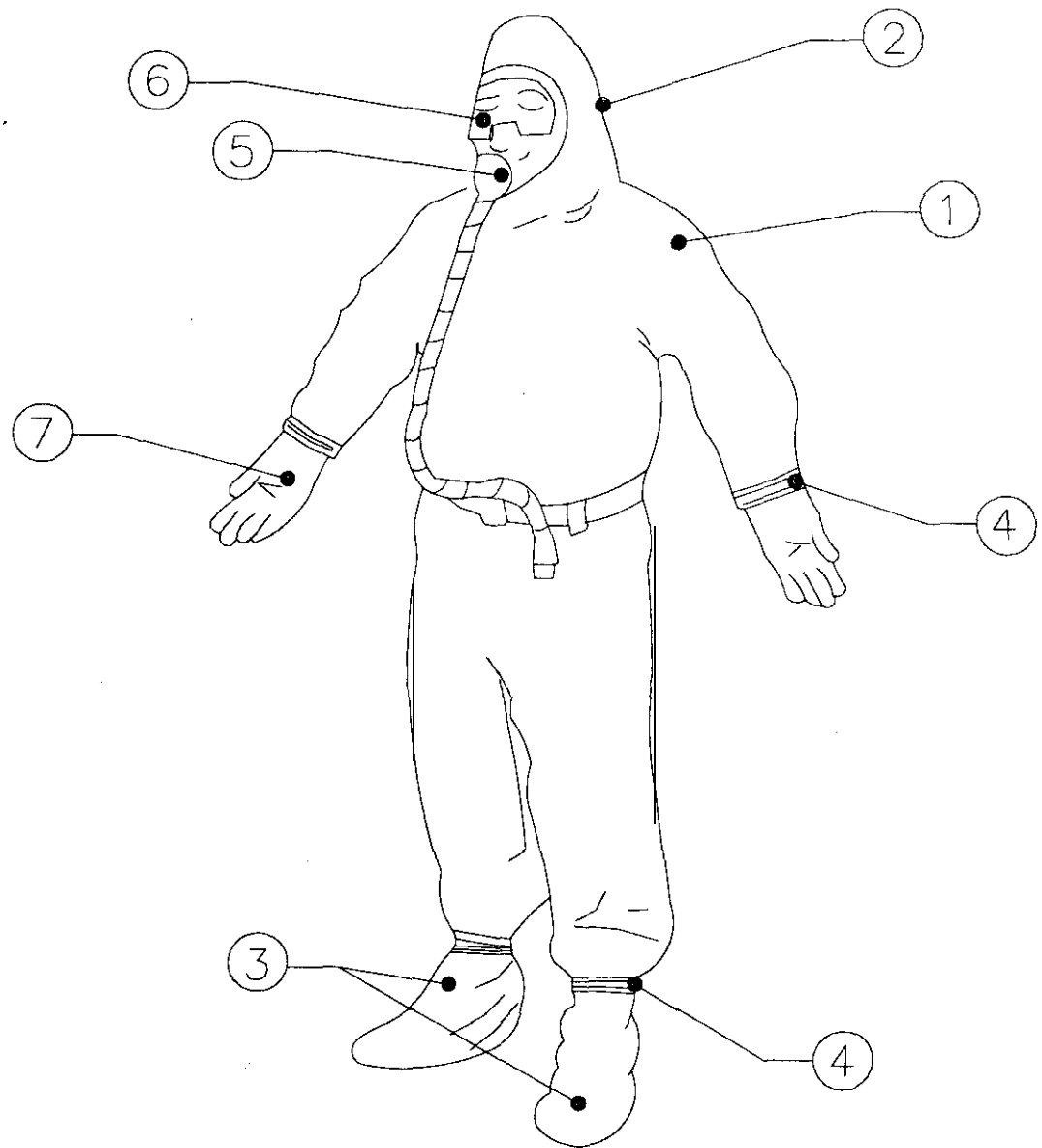
### Decontamination unit signage

1. Provide signs in English and other languages required by the contract.
2. Install at eye level.



**Disposal container label**

Attach warning labels to each disposal container removed from abatement area.



### Protective clothing

1. Disposable or reusable full body suit with elastic around hood and shoe cover openings is required or as otherwise specified in the contract.

2. Hood shall be worn over respirator's head and neck straps.



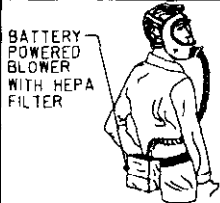
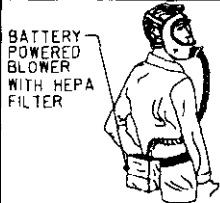



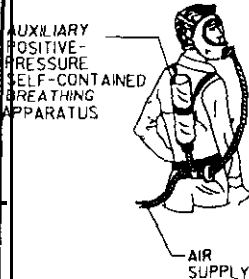
3. Shoe covers shall be worn over work shoes.

4. Cuffs shall be taped with duct tape at wrists and ankles in order to prevent infiltration.

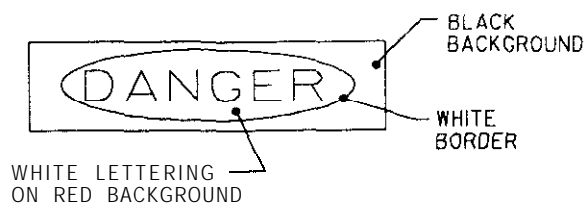
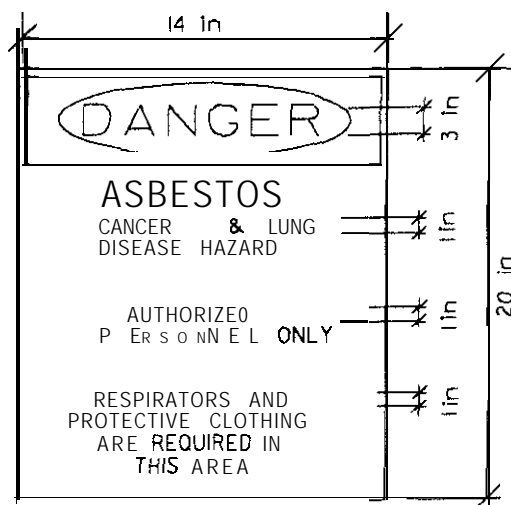
5. Cartridge-type air-purifying HEPA filter respirator is minimal requirement. Type shall be selected in accordance with sheet 12.

6. If eye protection is not integral with respirator, protection goggles are required.

7. Rubber work gloves are recommended to be worn alone or under outer work gloves provided for hand and operation safety.

FIBER CONCENTRATION	MINIMUM REQUIRED RESPIRATOR	
NOT IN EXCESS OF 1 FIBER/CC	HALF-MASK AIR PURIFYING RESPIRATOR WITH HEPA FILTERS	
NOT IN EXCESS OF 5 FIBERS/CC	FULL FACEPIECE AIR-PURIFYING RESPIRATOR WITH HEPA FILTERS	
NOT IN EXCESS OF 10 FIBERS/CC	LOOSE FITTING HELMET OR HOOD, POWERED AIR-PURIFYING RESPIRATOR WITH HEPA FILTERS	
NOT IN EXCESS OF 10 FIBERS/CC	POWERED AIR-PURIFYING RESPIRATOR WITH FULL FACEPIECE AND HEPA FILTER	
NOT IN EXCESS OF 10 FIBERS/CC	LOOSE FITTING HELMET OR HOOD, SUPPLIED AIR RESPIRATOR OPERATED IN CONTINUOUS FLOW MODE WITH BACK-UP HEPA FILTER	
NOT IN EXCESS OF 10 FIBERS/CC	SUPPLIED AIR RESPIRATOR WITH FULL FACEPIECE OPERATED IN CONTINUOUS FLOW MODE WITH BACK-UP HEPA FILTER	
NOT IN EXCESS OF 100 FIBERS/CC	FULL FACEPIECE SUPPLIED AIR RESPIRATOR OPERATED IN PRESSURE-DEMAND MODE WITH BACK-UP HEPA FILTER	
GREATER THAN 100 FIBERS/CC OR UNKNOWN CONCENTRATION	FULL FACEPIECE SUPPLIED-AIR RESPIRATOR OPERATED IN PRESSURE-DEMAND MODE WITH AUXILIARY POSITIVE-PRESSURE SELF-CONTAINED BREATHING APPARATUS	

Respiratory protection table

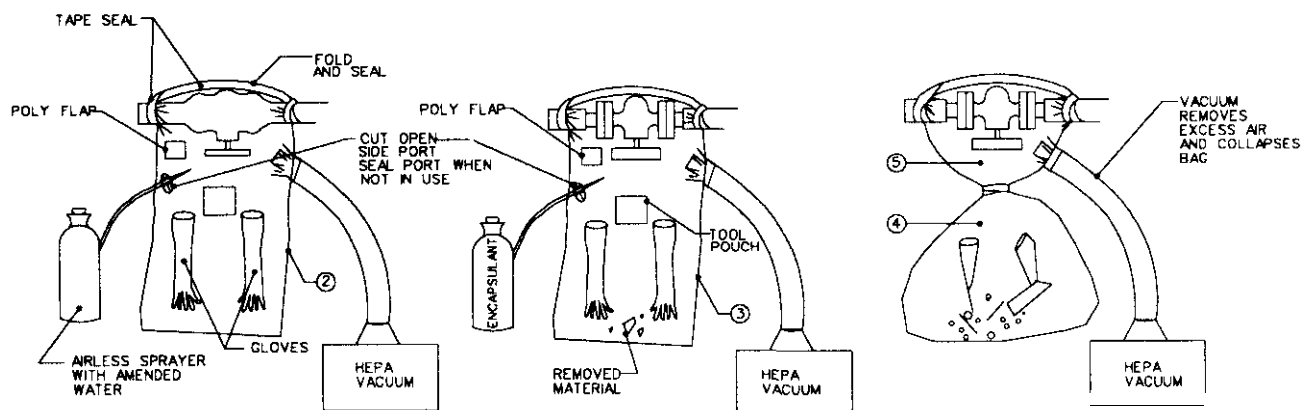


## AREA WARNING SIGNS AND WARNING TAPE

### DETAIL

#### Area warning signs and warning tape

1. Provide and install 14 mill [10.10 mm] polyethylene warning tape at locations shown on the abatement area plan.
2. Warning tape is to be attached to wood or metal posts at [10 ft] [300 cm] on center. Tape must be 13 ft [1100 cm] from ground.
3. Attach both warning signs at each entrance of the work area and at 133 yd [130 m] on center where security fencing is installed.
4. Warning signs must be in English and other languages required by the contract.
5. Install at eye level.



## Glove bag

1. Construct modified containment area in accordance with sheet 21. NOTE: Inspect for structural integrity the insulation material adjacent to section being removed, since glove bag removal procedure is not appropriate if it will cause asbestos fiber release from adjacent asbestos-containing material.

2. Put tools and rags inside glove bag. Insulation adjacent to the asbestos-containing material being removed must be adequately wet cleaned and sprayed with an encapsulant before placing glove bag **over** the area to be removed. Install glove bag according to manufacturer's instructions. (NOTE: Negative-air glove bags may be used if first approved by Contracting Officer. Manufacturer procedures for negative-air glove bags will vary from procedures identified on this sheet.) Install **HEPA** filter vacuum cleaner with hose **ducted** into bag. Seal with duct tape. Smoke test for leaks. Soak insulation with amended water.

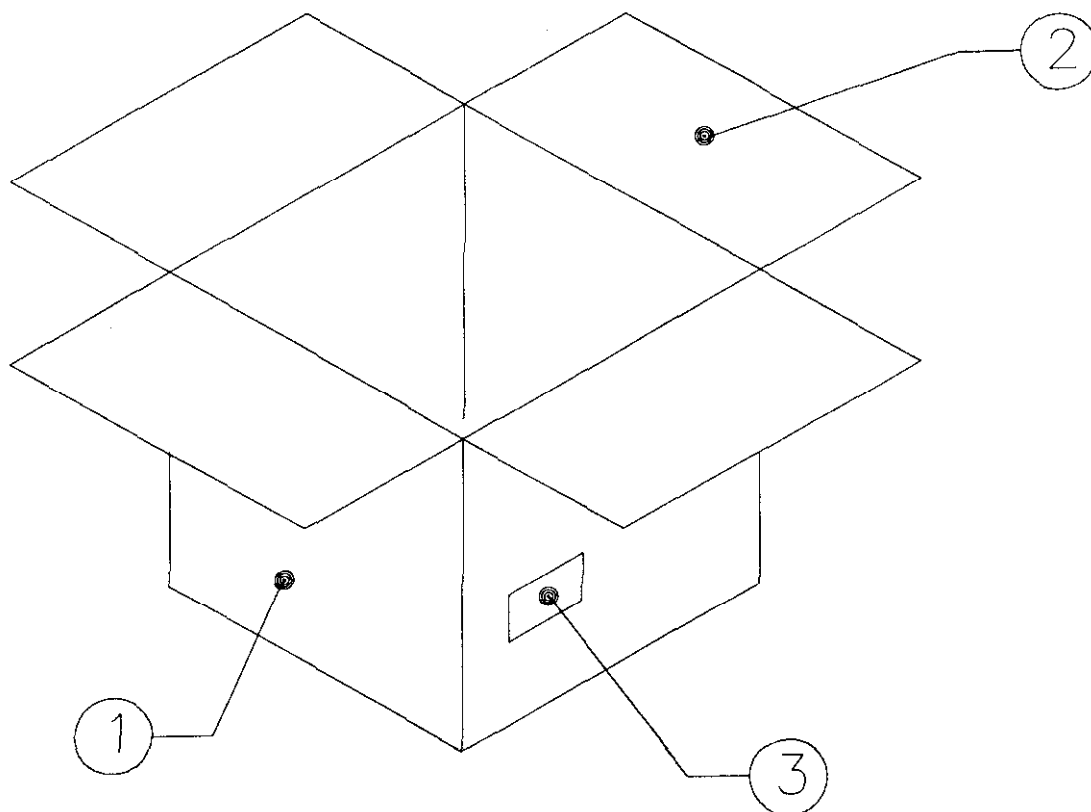
3. Remove insulation and clean exposed metal surfaces. Encapsulate exposed ends of insulation and metal surfaces. Adequately wet clean glove bag surfaces to below tool pouch.

4. Grasp tools in pouch and withdraw by pulling glove inside out. Twist glove above encased tools to create a constriction, and tape constricted area with duct tape. Cut through middle of taped area so that tools and glove bag will both remain sealed. **Place** encased tools into tool pouch of next glove bag or decontaminate by water immersion.

5. Evacuate glove bag, using **HEPA vacuum**. Twist bag to create a constriction below tool pouch. Wrap constricted area with duct tape. Cut bag [4 in] 110 cm] above constriction. Double bag cut off portion of bag; see sheet 9. Apply labels; see sheet 14. **Cap** and seal end of **HEPA** vacuum hose in order to prevent incidental fiber release.

6. Remove remaining portion of glove bag. Place in approved container; see sheet 9. Apply labels; **see** sheet 14. Dispose as asbestos-contaminated **waste**.

**Final clearance requirements.** For final clearance, Contractor and Contracting Officer will certify visual inspection of work area on sheet 19, *Certification of Final Cleaning and Visual Inspection*. Contract designee(s) will conduct final air-clearance monitoring as required by the contract.



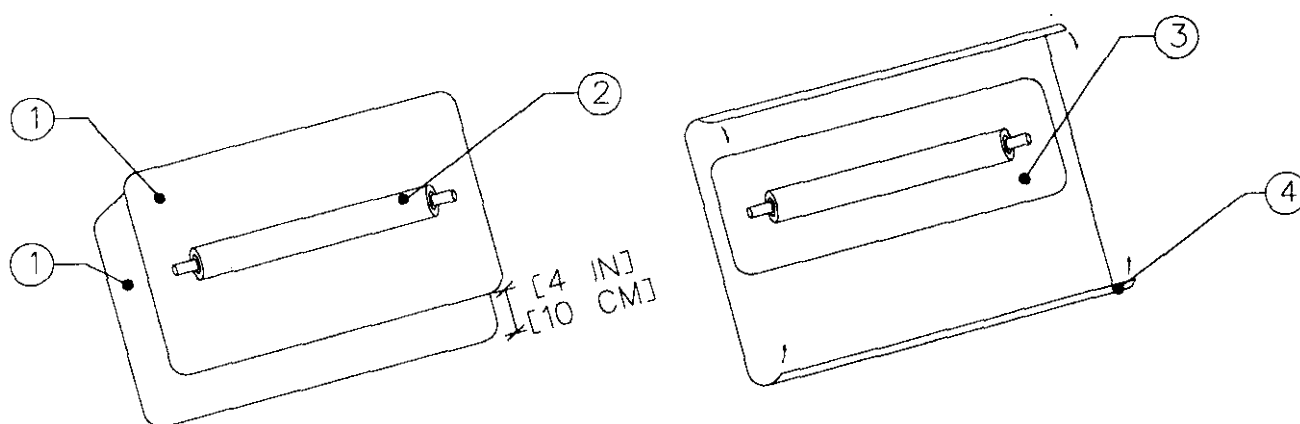
### Containers-corrugated cardboard boxes

1. Place still-wet asbestos-containing or asbestos-contaminated material that could puncture disposal bags into heavy-duty corrugated cardboard boxes coated with plastic or wax that will retard deterioration from moisture.

2. Close flaps, and seal with duct tape.

3. Apply labels; see sheet 14. Place box into disposal bags: see sheet 9A. Take to load-out unit; see sheet 20.





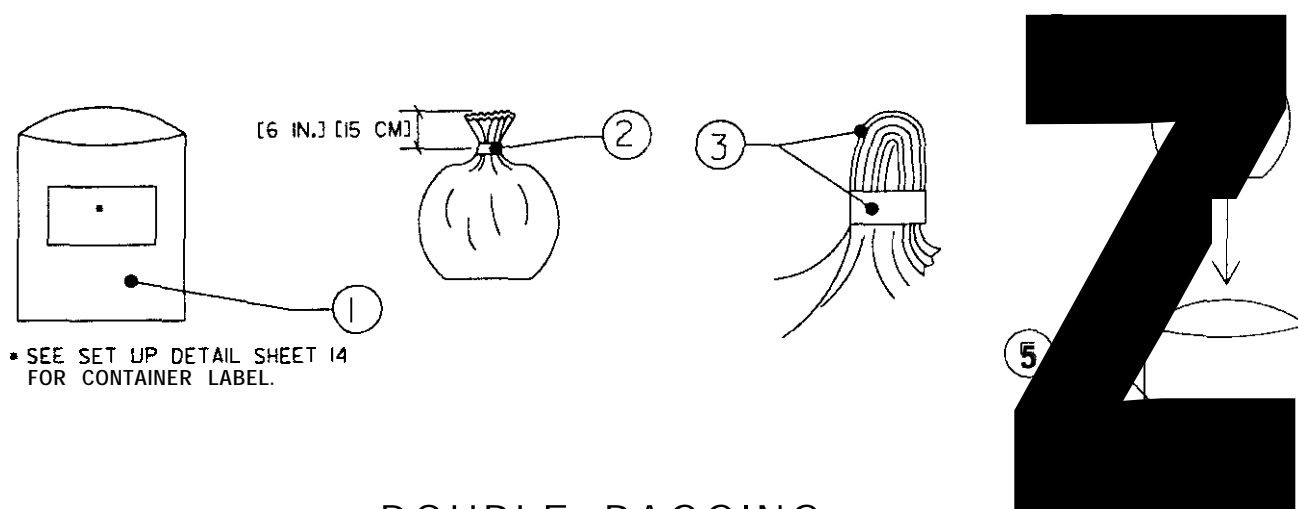
### Containers-leak-tight wrapping

1. Place two layers of 6-mil polyethylene sheet on surface so that the bottom layer is offset [4 in][10 cm] from the top layer.

2. Place the still-wet asbestos-containing or asbestos-contaminated material that is too large (boiler, vessel, pipe segment, etc.) to be placed in disposal bags on the top layer of polyethylene.

3. Wrap the top layer tightly around the contaminated material. Seal all edges of the top layer of sheeting with duct tape. Apply labels; see sheet 14.

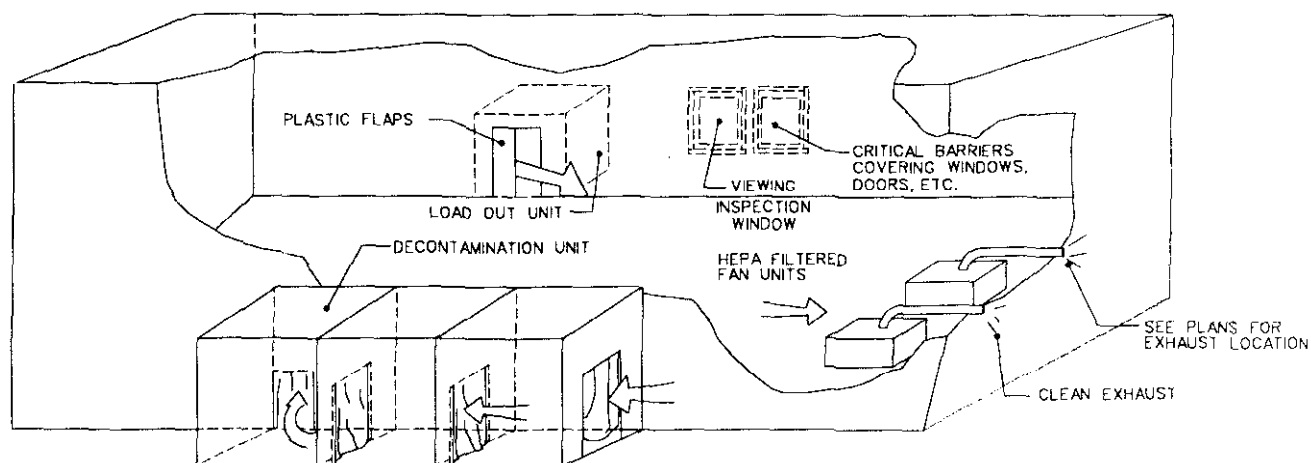
4. Repeat procedure with bottom layer, including labeling. Take to load-out unit; see sheet 20.



## DOUBLE BAGGING

### Containers-double bagging

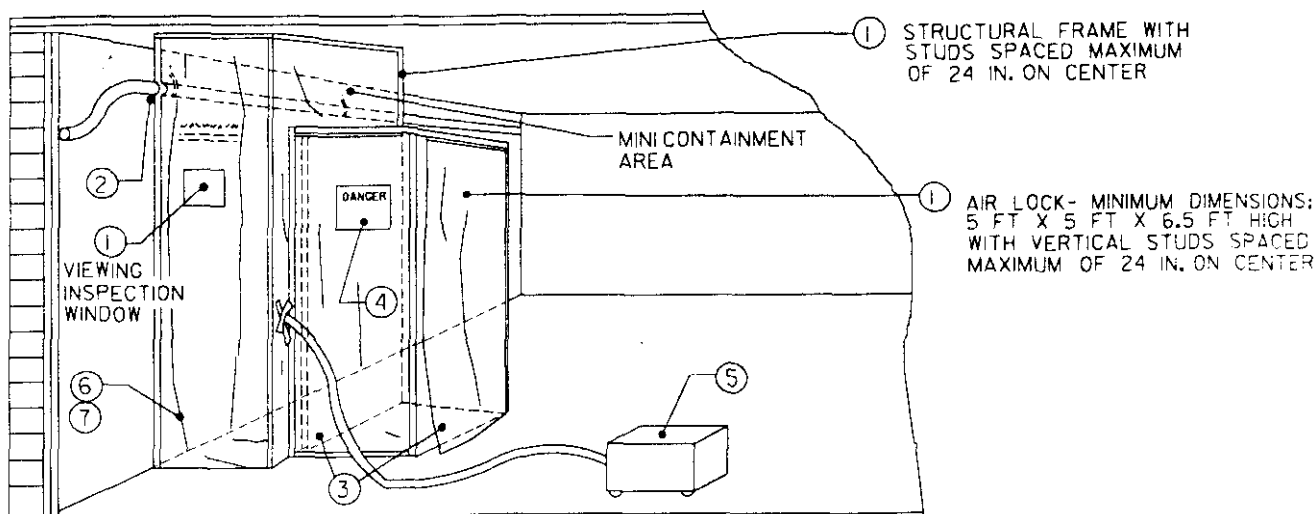
1. Place the still-wet asbestos-containing and asbestos-contaminated material into a pre-labeled **6-mil** polyethylene bag. Do not overfill. Do not use bag for asbestos-containing or asbestos-contaminated material that could puncture the bag. (See sheet **9C** for packaging items that could puncture bags.)
2. Evacuate with **HEPA** vacuum, and seal collapsed bag by twisting top **[6 in.] [15 cm]** closed and wrapping with a minimum of two layers of duct tape.
3. Twist top and fold over. Apply second wrap of duct tape.
4. Adequately wet clean outside of disposal bag by wet wiping, and take bag to the equipment and staging area.
5. Place bag inside a second pre-labeled **6-mil** polyethylene bag.
6. Seal outer bag by repeating steps 2 and 3 above. Take bag to load-out unit; see sheet 20.



### Ventilation of containment area and decontamination unit, using HEPA filters

1. Install a ventilation system in the containment area that draws the air supply through the decontamination and load-out units. See sheets 20 and 22.
2. Operate ventilation system 24 hours a day from start of abatement through final clearance.
3. Place at the decontamination unit entrance a pressure gauge that measures differential pressure between abatement and ambient areas. Gauge must be read hourly and logged or continuously recorded.
4. The ventilation system must create, as a minimum, a negative pressure of 0.02 inches of water inside the containment area (relative to the outside of the containment area) and must be sized for a minimum of four air changes per hour or more, as specified in the contractor's asbestos hazard abatement plan.
5. Locate HEPA filters in order to prevent dead air pockets.
6. Exhaust filtered air to outside of building, unless otherwise approved by the Contracting Officer.

**Final clearance requirements.** For final clearance, remove ventilation system upon instruction from the Contracting Officer and relocate to equipment room of decontamination unit. Thoroughly HEPA vacuum unit and ducting. Adequately wet clean all surfaces and wheels of unit(s). Collect all waste debris and unit filters, and treat as asbestos-contaminated material, placing in approved container; see sheet 9. Apply labels; see sheet 14. Dispose of waste as required by the contract. Wrap unit in one layer of 6-mil polyethylene sheeting, and seal with duct tape before removing from job location.



### Mini-containment area

1. Establish work area so that unauthorized entry is prevented; see sheet 11. Construct a two-compartment wood frame around work area; install one layer 6-mil polyethylene sheeting to structural members and two layers 6-mil polyethylene sheeting to the floor. Seal all edges to wall, ceiling, and floor surfaces with duct tape. Install viewing inspection windows, where feasible.

2. Seal with duct tape all penetrations (typical) such as pipes, electrical conduit, or ducts.

3. Install triple 6-mil polyethylene flaps at both doorways. Place portable sprayer with clean water, disposable towels, and prelabeled disposal bag in air lock.

4. Install danger signs on outside of containment area. See sheet 11.

5. Install HEPA vacuum; extend hose into mini-containment area for general vacuuming, negative air, and cleaning of disposable suit.

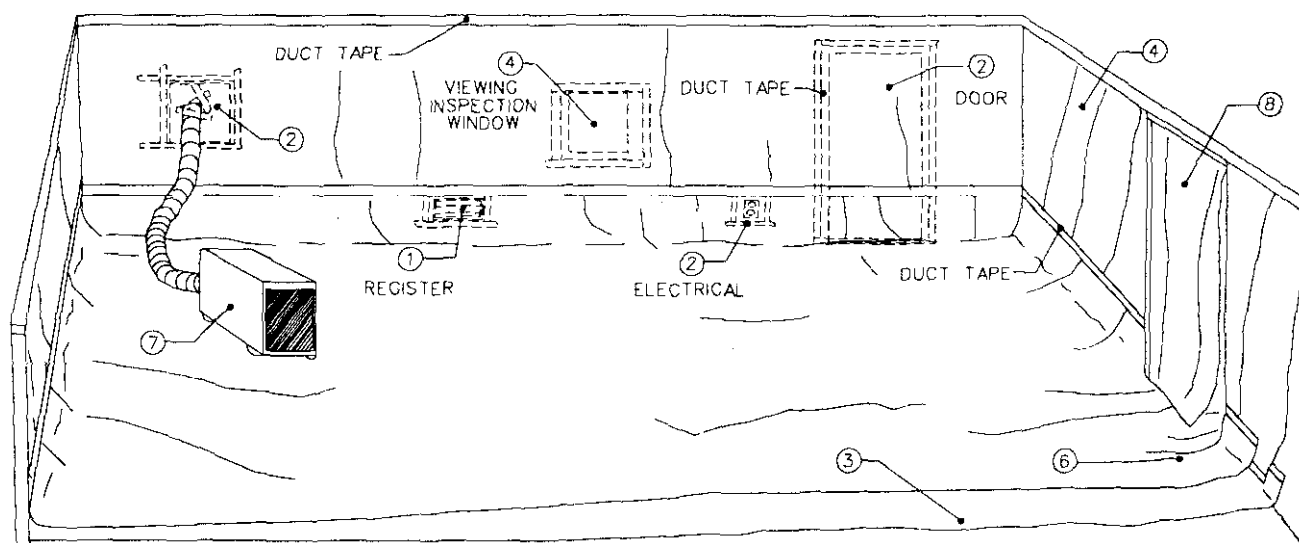
6. Accumulate all loose materials for disposal. Place in approved container; see sheet 9. Apply labels; see

sheet 14. Adequately wet clean all wall, floor, tool, and equipment surfaces.

7. Abatement worker must wear two disposable suits. Remove outer suit in work area and place in a plastic bag; see sheet 9. Enter air lock.

8. In air lock, wet wipe respirator and wash hands with clean water. Remove respirator and place in a clean plastic bag. Proceed to remote shower unit where inner suit may be removed.

**Final clearance requirements.** After abatement is completed, prepare area for final clearance. Contractor and Contracting Officer will certify visual inspection of work area on sheet 19, *Certification of Final Cleaning and Visual Inspection*. Contractor will apply lockdown encapsulant. Contract designee(s) will conduct final air-clearance monitoring as required by the contract. Remove containment area upon instructions from the Contracting Officer, and treat it as asbestos-contaminated material. Place in approved container; see sheet 9. Apply labels, see sheet 14. Dispose of as specified in the contract.



### Installation of critical barrier and full containment area (for hard floor surfaces)

1. Establish work area so that unauthorized entry is prevented; see sheet 11. Eliminate airflow into containment area by isolation of all supply and return air ducts from mechanical system. Lock doors and windows not required for access.

2. Install 6-mil polyethylene critical barriers over all windows, doors, wall openings, electrical outlets, etc. Secure with duct tape on all sides. HEPA vacuum furniture, fixtures, and equipment and remove from or protect in containment area, as specified by the contract.

3. Install first layer of 6-mil polyethylene on floor, extending the polyethylene 18 inches up wall. Secure with duct tape.

4. Protect wall surface with 6-mil polyethylene from floor to ceiling. Install view inspection windows, where feasible.

5. Prepare area as follows: turn off electrical power and remove light fixtures. Protect ceiling as required, HEPA vacuum floor and walls.

6. Install top layer of 6-mil polyethylene.

7. Install HEPA filter unit and duct work; see sheet 8.

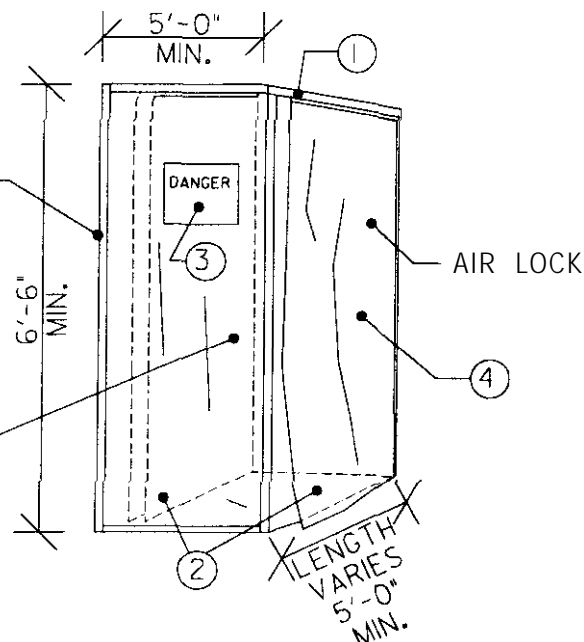
8. Prepare door into decontamination unit or load-out unit; see sheet 22 for decontamination unit and sheet 20 for load-out unit. Doors that swing into the work area must be removed from hinges.

**Final clearance requirements.** After abatement has been completed, see sheet 17 for final clearance requirements.

## Part 2, Setup Details

FRAME AIR-LOCK WITH VERTICAL STUDS SPACED A MAXIMUM OF 24 IN. ON CENTER EXCEPT AT 3'-0" OPENINGS. PROVIDE HORIZONTAL FRAMING MEMBERS AT TOP AND BOTTOM.

COVER WALLS AND ROOF FRAMING WITH PLYWOOD AND COVER WITH 2 LAYERS OF 6 MIL POLYETHYLENE. TAPE ALL JOINTS.



### Air lock

1. Establish work area so that unauthorized entry is prevented; see sheet 11. Construct a wood frame. Install one layer of **6-mil** polyethylene sheeting to structural members and two layers to the floor. Seal all edges of sheeting to wall, ceiling, and floor surfaces with duct tape.
2. Install triple flaps of **6-mil** polyethylene sheeting at both doorways.
3. Install danger signs on each side of air lock area; see sheet 11.
4. Before leaving work area, remove outer **suit**. Place in a plastic bag; see sheet 9.

5. Enter air lock. Wet wipe respirator and wash hands with clean water from portable sprayer. Remove respirator, and place in a clean plastic bag. Proceed to shower, where inner suit may be removed.

**Final clearance requirements.** After abatement is completed, prepare area for final clearance. Contractor and Contracting Officer will certify visual inspection of work area on sheet 19, *Certification of Final Cleaning and Visual Inspection*. Contract designee(s) will conduct final air-clearance monitoring as required by the contract. Remove containment area upon instructions from the Contracting Officer, and treat as asbestos-contaminated material; see sheets 9 and 14.

SECTION 02090  
LEAD-BASED PAINT (LBP) ABATEMENT AND DISPOSAL  
04/94

**PART I. GENERAL**

**See Description of Work below for details lead paint abatement.**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1926	Safety and Health Regulations for Construction
40 CFR 148	Hazardous Waste Injection Restrictions
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 268	Land Disposal Restrictions
49 CFR 172	Hazardous Material Table, Special Provisions, Hazardous Material Communications, Emergency Response Information, and Training Requirements
49 CFR 178	Specifications for Packaging

ENGINEERING MANUALS (EM)

EM 385-1-1	(1992) U.S. Army Corps of Engineers Safety and Health Requirements Manual
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701	(1989) Methods of Fire Test for Flame-Resistant Textiles and Films
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NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH OSHA Booklet 3142

Lead in Construction

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

SD-08 Statements

Lead-Based Paint (LBP) Management Plan; GA; CD

The Contractor shall review the specified abatement work tasks and abatement methods and shall prepare a detailed LBP Management Plan that identifies the work procedures, health, and safety measures to be used in LBP abatement. The plan shall address the various sources of lead and the methods to be undertaken to abate the lead hazards to include the following key elements:

- a. Location of LBP containing components keyed to project drawings.
- b. Means for notifying occupants of proposed work schedules.
- c. Training requirements as required by Federal, state, and local regulations.
- d. Unique problems associated with the LBP abatement project.
- e. Sketch of LBP control areas and decontamination areas.
- f. Eating, drinking, smoking, and rest room procedures.
- g. Sequencing of LBP related work.
- h. Personnel protective equipment; respiratory protection program and controls.
- i. Engineering controls, containment structures and safety measures.
- j. Worker exposure assessment procedures.
- k. Work Practice controls.
- l. Housekeeping.
- m. Hygiene facilities and practice.
- n. Medical surveillance, including medical removal protection.
- o. Sampling, testing and analytical methods to include personal air sampling requirements of 29 CFR 1926 Section .62 and toxicity characteristic leaching procedure (TCLP) of the waste material in accordance with 40 CFR 261. Procedures must include frequency, locations, and sampling and analytical methods to be used.

Hazardous Waste Management Plan; GA; CD

A Hazardous Waste Management Plan shall be prepared that complies with applicable requirements of Federal, state, and local hazardous waste regulations and addresses:

- a. Identification or documentation of potential hazardous wastes associated with the work.
- b. Estimated quantities of wastes to be generated and disposed of.
- c. Names and qualifications of each Contractor that will be transporting, storing, treating, and disposing of the wastes; the facility location, phone number, and name of a 24-hour point of contact shall be included. Two copies of EPA, state, and local hazardous waste permit applications, permits, and EPA identification numbers.
- d. Names and qualifications (experience and training) of personnel who will be working onsite with hazardous waste.
- e. List of waste handling equipment to be used in performing the work



- to include cleaning, volume reduction, and transport equipment.
- f. Spill prevention, containment, and clean-up contingency measures to be implemented.
- g. Work plan and schedule for waste containment, removal, and disposal. Waste shall be cleaned up and containerized daily.
- h. Cost for hazardous waste disposal according to this plan.

#### Waste Disposal Plan; GA; CD

A Waste Disposal Plan shall be prepared that will include but not be limited to the following:

- a. A written confirmation that the debris will be treated and disposed of in accordance with the requirements of 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 264 and 40 CFR 268.
- b. A written confirmation that transportation of the debris will be in accordance with 40 CFR 263.
- c. Waste subcontractor's name, address, telephone number, and landfill location, including copies of licenses and signed agreements.
- d. Landfill name, address, and telephone number. A copy of the landfill's state and locally issued license, and a signed agreement that the landfill will accept the LBP wastes.
- e. Detailed delivery tickets prepared, signed, and dated by an agent of the landfill, certifying the amount of LBP containing materials delivered to the landfill, within 3 days after delivery.

The Contractor shall complete and provide final completed copies of the Waste Shipment Record for all shipments of waste material as specified in 40 CFR 61, Subpart M including EPA form 8700-22 with Stephen Kauffman, Eglin AFB Environmental Manager, signing as generator. Mr Kauffman can be reached at (904)882-6282, Ext 253 and at AFDTC/EMCW, 501 DeLeon St. Suite 101, Eglin AFB, FL 32542-5133. Detailed information of all other required state waste manifest shipment records within 3 days of delivery to the landfill.

#### SD-09 Report

#### Sampling Result; GA; CD

A daily log of the personal air sampling test results shall be reviewed by the Competent Person and submitted, in written form, no more than 48 hours after completion of the sampling cycle. The log shall list each sample result, sampling time and date, sample type, identification of personnel monitored, flow rate and duration, air volume sampled, yield of lead, cassette size, analytical method used, analyst's name and company, and interpretation of results. Results shall be reported in micrograms of lead per cubic meter of air. Documentation of results that exceed specified limits (personal air samples that exceed 30 micrograms per cubic meter) or as required by Federal, state or local requirements shall be highlighted in the log in such a manner to make them easily distinguishable from monitoring results that do not exceed specified or regulatory limits.

#### SD-13 Certificates

#### Quality Assurance; GA\; CD

Certificates shall meet the requirements of paragraph QUALITY ASSURANCE. The statements shall be signed and dated by a certifying officer after the award of this contract and contain the following:

- a. Contractor's name and address.
- b. Project name and location.
- c. The specified requirements that are being certified.

### **1.3 QUALITY ASSURANCE**

#### **1.3.1 Qualifications**

- a. Contractor: Certification that the Contractor has prior experience on LBP abatement projects similar in nature and extent to ensure the capability to perform the abatement in a satisfactory manner.
- b. Competent Person: Certification that the Contractor's full-time onsite Competent Person meets the competent person requirements of 29 CFR 1926 Section .62 and is experienced in administration and supervision of LBP abatement projects, including work practices, protective measures for building and personnel, disposal procedures, etc. This person shall have completed a Contractor Supervisor LBP abatement course by an EPA Training Center or an equivalent certification course, and have had a minimum of 2 years on-the-job experience.
- c. Testing Laboratory: The name, address, and telephone number of the independent testing laboratory selected to perform analysis for personal air samples and TCLP analysis. Documentation that the laboratory performing the analysis is an EPA National Lead Laboratory Accreditation Program (NLLAP) accredited laboratory and that it is rated proficient in the NIOSH/EPA Environmental Lead Proficiency Analytical Testing Program (ELPAT). Certification shall include accreditation for heavy metal analysis, list of experience relevant to analysis of lead in air, and a Quality Assurance and Quality Control Program. Currently, the American Association for Laboratory Accreditation (ASLA) and the American Industrial Hygiene Association (AIHA) are the EPA recognized laboratory accreditors. Documentation shall include the date of accreditation or reaccreditation.
- d. Blood Lead Testing Laboratory. The name, address and telephone number of the blood lead testing laboratory; the laboratory's listing by OSHA and the U.S. Public Health Service Center for Disease Control (CDC); and documentation that the laboratory certified in the state where the work site is located.

#### **1.3.2 Respiratory Protection Devices**

Manufacturer's certification of NIOSH or the Mine Safety and Health Administration (MSHA) approval for respiratory protection devices utilized on the site.

#### **1.3.3 Cartridges, Filters, and Vacuum Systems**

Manufacturer's certification of NIOSH approval of respirator cartridges (organic vapor, acid gas, mist, dust, high efficiency particulate); High Efficiency Particulate Air (HEPA) filtration capabilities for all cartridges, filters, and HEPA vacuum systems.

#### **1.3.4 Medical Records**

Certification that employees who are involved in LBP abatement work have received medical examinations and will receive continued medical surveillance, including biological monitoring, as required by 29 CFR 1926 Section .62 and by the state and local regulations pertaining to such work. Records shall be retained, at Contractor expense, in accordance with 29 CFR 1910 Section .20.

#### **1.3.5 Training**

Training certification shall be provided prior to the start of work involving LBP abatement, for all of the Contractors' workers, supervisors and Competent Person. Training shall meet the requirements of 29 CFR 1926 Section .62, 29

CFR 1926 Section .59 and 49 CFR 172, and that required by EPA or the state LBP course for the work to be performed. Training shall be provided prior to the time of job assignment and, at least, annually. Training may cover all abatement methods or focus only on those methods specified in the LBP Management Plan. The project specific training shall, as a minimum, include the following:

- a. Specific nature of the operation which could result in exposure to lead.
- b. Purpose, proper selection, fitting, use, and limitations of respirators.
- c. Purpose and description of the medical surveillance program and the medical removal protection program, including information concerning the adverse health effects associated with excessive exposure to lead (with particular attention to the adverse reproductive effects on both males and females and hazards to the fetus and additional precautions for employees who are pregnant).
- d. Relevant engineering controls and good work practices.
- e. The contents of any compliance plan in effect.
- f. Instructions to employees that chelating agents should not routinely be used to remove lead from their bodies and should not be used at all except under the direction of a licensed physician.
- g. The employee's right of access to records under 29 CFR 1910 Section .20.

#### **1.3.6 Licenses and Permits**

Copies of licenses and permits as required by applicable Federal, state, and local regulations shall be obtained at least 20 days before the start of the LBP abatement project.

#### **1.4 DESCRIPTION OF WORK**

The Contractor shall remove painted metal handrails from Sector D. The handrail posts are embedded in the concrete stairs of exterior stairways. To remove them, the Contractor shall cut the handrail posts flush with the concrete stairs. For ease of handling, the Contractor may also cut the handrail into sections to remove the entire length of handrail from the building. The Contractor shall erect temporary handrails for fall protection per EM 385-1-1, Chapter 21 and OSHA regulations until new handrails are installed. See the contract drawings for location of handrails. See CLEANUP AND DISPOSAL paragraph below for testing and disposal requirements. Quantities of handrail removal are as follows:

- a. Additive Alternate #1: Approximately 192 total linear feet (LF) of painted metal handrail located in four stairwells.
- b. Additive Alternate #2: Approximately 192 total linear feet (LF) of painted metal handrail located in four stairwells.
- c. Additive Alternate #3: Approximately 48 total linear feet (LF) of painted metal handrail located in one stairwell.
- d. Additive Alternate #4: Approximately 48 total linear feet (LF) of painted metal handrail located in one stairwell.

#### **1.5 ADDITIVE ALTERNATES**

a. Additive alternates 1 and 2 include all lead paint removal within sector D as shown on the contract drawings.

b. Additive alternates 3 includes lead paint removal in one stairwell within sector D as shown on the contract drawings.

**c. Additive alternates 3 includes lead paint removal in one stairwell within sector D as shown on the contract drawings.**

#### **1.6 SITE VISIT**

Contractor shall visit and investigate the site, review the drawings and specifications, assess the amount of LBP, and become familiar with conditions which will affect the work.

#### **1.7 LIABILITY INSURANCE FOR LBP**

LBP abatement liability insurance shall be obtained without additional expense to the Government. The Contractor shall assume full responsibility and liability for the compliance with Federal, state, and local regulations pertaining to training, work practices, hauling, disposal, and protection of workers, visitors to the site, and persons occupying areas adjacent to the site.

#### **1.8 PROTECTION OF EXISTING WORK TO REMAIN**

Abatement, storage, transportation, and disposal work shall be performed without damaging or contaminating adjacent work and areas. Where such work or areas are damaged or contaminated, the Contractor shall restore work and areas to the original condition at no additional cost to the Government.

#### **1.9 COORDINATION WITH OTHER WORK**

Abatement and disposal work shall be coordinated with existing work and/or concurrent work being performed in adjacent areas.

#### **1.10 SAFETY AND HEALTH REGULATORY REQUIREMENTS**

Work shall be performed in accordance with requirements of EM 385-1-1 and applicable regulations including, but not limited to 29 CFR 1910, 29 CFR 1926, especially Section .62. Matters of interpretation of the standards shall be submitted to the appropriate agency for resolution before starting work. Where these requirements vary, the most stringent shall apply.

#### **1.11 PRECONSTRUCTION SAFETY MEETING**

The Contractor and the Contractor's Competent Person shall attend a preconstruction safety meeting prior to starting any work involving LBP abatement. Items required to be submitted will be reviewed for completeness, and where specified, for acceptance.

#### **1.12 ACCIDENT PREVENTION PLAN**

##### **1.12.1 Preparation and Implementation**

The Accident Preparation Plan (APP) shall be prepared in accordance with EM 385-1-1, Table 1-1. Where topic in table 1-1 is not applicable, the APP shall justify its omission or reduced level of detail, and establish that adequate consideration was given to the topic. The APP shall cover onsite work by the Contractor or subcontractors. The Competent Person shall be responsible for development, implementation, and quality control of the content and actions required in the APP. For each anticipated work task, the APP shall establish hazards and control measures. The APP shall be easily readable and understandable by the Contractor's work force.

### **1.12.2 Acceptance and Modifications**

The APP shall be prepared, signed and dated by the Contractors Competent Person and submitted 10 days prior to the preconstruction safety conference. Deficiencies in the APP shall be discussed at the Preconstruction Safety Conference and the APP shall be revised to correct the deficiencies, and resubmitted for acceptance. Onsite work shall not begin until the APP has been accepted unless otherwise authorized by the Contracting Officer's Representative. One copy of the APP shall be maintained in the Contractor's jobsite file, and a second copy shall be posted where it will be accessible to personnel on the site. As work proceeds, the APP shall be adapted to new situations and conditions. Changes to the APP shall be made with concurrence of the Competent Person and Site Superintendent, and acceptance of the Contracting Officer's Representative. Should an unforeseen hazard become evident during performance of the work, the Competent Person shall bring such hazard to the attention of the Superintendent and the Contracting Officer's Representative, both verbally and in writing, for resolution as soon as possible. In the interim, the Contractor shall take necessary action to re-establish and maintain safe working conditions; and to safeguard onsite personnel, visitors, the public, and the environment. Disregard for provisions of this specification, or the accepted APP shall be cause for stopping of work until the matter is rectified.

### **1.12.3 Activity Hazard Analyses**

An Activity Hazard Analysis (AHA) shall be prepared prior to beginning each major phase of the work and submitted for review and acceptance. Format shall be in accordance with EM 385-1-1, figure 1-1. A major phase of work is defined as an operation involving hazards not experienced in previous operations, or where a new work crew is to perform. The analysis shall define the activities and the sequence in which they are to be performed, specific hazards anticipated, and control measures to be implemented to eliminate or reduce each hazard to an acceptable level. Work shall not proceed on that phase until the Activity Hazard Analysis has been accepted and a preparatory meeting has been conducted by the Contractor to discuss content of the AHA with everyone engaged in the activity, including the Government's onsite representative. The AHA shall be continuously reviewed and modified when appropriate to address changing conditions or operations. The accepted AHA shall be appended to and become part of the APP.

### **1.13 RESPIRATORY PROTECTION PROGRAM**

A respiratory protection program shall be established as required by 29 CFR 1926 Section .103 and .62 and in accordance with 29 CFR 1910 Section .134. An approved respirator shall be furnished to each employee and visitor required to enter a LBP work control area. A fit test shall be conducted in accordance with 29 CFR 1926 Section .62, Appendix D.

### **1.14 HAZARD COMMUNICATION PROGRAM**

A Hazard Communication Program shall be implemented in accordance with 29 CFR 1926 Section .59.

### **1.15 SAFETY AND HEALTH OVERSIGHT**

The Competent Person shall be the onsite person responsible for coordination, safety, security and execution of the work. The Competent Person shall be able to identify existing and predictable lead hazards and shall have the authority to take corrective measures to eliminate them. The Competent Person shall be responsible for personal sampling.

#### **1.16 PREPARATORY INSPECTION MEETING**

The Contractor and the Contractor's Competent Person shall arrange and hold a preparatory inspection meeting immediately prior to beginning any LBP abatement. The APP, Activity Hazard Analyses, and the Contractor's LBP Management Plan, including containment, engineering controls, worker protection, training, and monitoring, will be reviewed for completeness.

#### **1.17 TRAINED AND COMPETENT PERSONNEL**

Work shall be performed by Competent Persons, qualified and trained in the abatement, enclosure, encapsulation, monitoring, testing, storage, treatment, hauling, and disposal of contaminated LBP debris material, and in subsequent cleanup of the affected environment. Workers shall comply with the appropriate Federal, state, and local regulations which mandate training requirements and work practices and shall be capable of performing the work under this contract.

#### **1.18 POSTED WARNINGS AND NOTICES**

The following regulations, warnings, and notices shall be posted at the work site in accordance with 29 CFR 1926 Section .62.

##### **1.18.1 Regulations**

Two copies of applicable Federal, state, and local regulations and NIOSH OSHA Booklet 3142 shall be maintained. One copy shall be posted at the work site and one copy shall be on file in the project office.

##### **1.18.2 Warning Signs and Labels**

Warning signs shall be provided at building entrances and approaches to LBP control areas containing airborne LBP debris. Signs shall be located at a distance from the LBP control areas that will allow personnel to read the sign and take the necessary protective actions required before entering the LBP control area.

###### **1.18.2.1 Warning Signs**

Warning signs shall be in English and be of sufficient size to be clearly legible and display the following:

WARNING  
LEAD WORK AREA  
POISON  
NO SMOKING OR EATING  
AUTHORIZED PERSONNEL ONLY  
RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

###### **1.18.2.2 Warning Labels**

Warning labels shall be in English and be of sufficient size to be clearly legible and display the following:

CAUTION: CLOTHING CONTAMINATED WITH LEAD. DO NOT REMOVE DUST BY BLOWING OR SHAKING. DISPOSE OF LEAD CONTAMINATED WASH WATER IN ACCORDANCE WITH APPLICABLE FEDERAL, STATE OR LOCAL REGULATIONS.

### **1.18.3 Worker Information**

Right-to-know notices shall be placed in clearly visible areas of the work site in compliance with Federal, state, and local regulations.

### **1.18.4 Air Monitoring Results**

Daily air monitoring results shall be prepared so as to be easily understood by the workers, and shall be placed in a clearly visible area of the work site.

### **1.18.5 Emergency Telephone Numbers**

A list of telephone numbers shall be posted at the site. The list shall include numbers of the local hospital, emergency squad, police and fire departments, Government and Contractor representatives who can be reached 24 hours per day, and professional consultants directly involved in the project.

## **1.19 EQUIPMENT AND MATERIALS**

Sufficient quantities of health and safety materials required by 29 CFR 1926 Section .62, and other materials and equipment needed to complete the project, shall be available and kept on the site.

### **1.19.1 Respirators**

Air-purifying respirators shall be approved by NIOSH for use with dust, fumes, and mists having permissible exposure limits less than 0.05 milligrams per cubic meter (i.e., have high-efficiency particulate air (HEPA) filters) and for other hazardous airborne contaminants that may be encountered, as determined by the Competent Person. Respirators shall comply with the requirements of 29 CFR 1926 Section .62 and shall be used in accordance with 29 CFR 1926 Section .103 and 29 CFR 1910 Section .134.

### **1.19.2 Respirator Cartridges**

A sufficient supply of respirator cartridges shall be maintained at the work site to provide new cartridges to employees, authorized visitors, and Government personnel throughout the duration of the project. Cartridges shall be replaced according to the manufacturer's recommendations, when breathing becomes difficult, or if the cartridge becomes wet.

### **1.19.3 Protective Clothing**

The Contractor shall furnish, at no cost to personnel, equipment/clothing for protection from airborne and waterborne LBP debris. Three complete sets of personal protective equipment shall be made available to the Contracting Officer's Representative and authorized visitors for entry to the asbestos regulated work area at all times for inspection of the asbestos regulated work area. Workers and visitors shall not take protective clothing and equipment off the work site at any time.

### **1.19.4 Expendable Supplies**

#### **1.19.4.1 Polyethylene Sheet and Bags - General**

Polyethylene sheet and bags shall be minimum 6 mils thick. Bags shall have pre-printed labels, and 5 inch (minimum) long plastic ties, pointed and looped to secure the filled bags. Polyethylene sheets shall be in roll sizes to minimize seams.

#### **1.19.4.2 Polyethylene Sheet - Reinforced**

Reinforced polyethylene sheet shall be provided where high skin strength is required such as where it constitutes the only barrier between the LBP control area and the outdoor environment. The sheet stock shall consist of translucent, nylon-reinforced or woven-polyethylene thread laminated between two layers of polyethylene film. Film shall meet flame resistant standards of NFPA 701.

#### **1.19.4.3 Tape and Adhesive Spray**

Tape and adhesive shall be capable of sealing joints between polyethylene sheets and for attachment of polyethylene sheets to adjacent surfaces. After dry application, tape or adhesive shall retain adhesion when exposed to wet conditions, including amended water. Tape shall be minimum 2 inches wide, industrial strength.

#### **1.19.4.4 Containers**

Impermeable containers shall be used to receive and retain lead contaminated material until disposal. Containers shall be labeled in accordance with EPA, DOT and OSHA standards.

#### **1.19.4.5 Chemicals**

Chemicals, including caustics and paint strippers, shall be properly labeled and stored in leak-tight containers.

#### **1.19.5 Vacuum Systems**

HEPA filtered vacuum systems shall be used during abatement operations which generate dust. The systems shall be suitably sized for the project, and filters shall be capable of removing particles as small as 0.3 micrometers at a minimum efficiency of 99.97 percent.

### **1.20 STORAGE OF MATERIALS**

Materials shall be stored in a place and manner which protects them from damage and contamination. During periods of cold weather, plastic materials shall be protected from the cold. No flammable or hazardous materials shall be stored inside any building. Regularly inspect materials to identify damaged or deteriorating items. Damaged or deteriorated items shall not be used and shall be removed from the site as soon as they are discovered. Any materials which become contaminated with LBP waste shall be disposed of consistent with the requirements of 40 CFR 148 and these specifications. Stored materials shall not present a hazard or an inconvenience to workers, visitors, and/or other occupants and employees of the building.

## **PART 2 PRODUCTS (NOT APPLICABLE)**

## **PART 3 EXECUTION**

### **3.1 WORK PROCEDURES**

LBP abatement and related work shall be performed in accordance with the accepted Contractor's LBP Management Plan as modified and approved. Procedures and equipment required to limit occupational and environmental



exposures to lead during LBP removal shall be in accordance with 29 CFR 1926 Section .62, and as specified herein. Paint chips and associated waste shall be disposed of in compliance with Federal, state, and local regulations.

#### **3.1.1 Personnel Protection Procedures**

Personnel shall wear and use protective clothing and equipment as specified. Eating, smoking, drinking, chewing tobacco and chewing gum, and applying makeup shall not be permitted in the LBP control area. Personnel of trades not engaged in the abatement and disposal of LBP shall not be exposed at any time to airborne concentrations of lead equal to or in excess of 30 micrograms per cubic meter of air. Electrical service shall be disconnected when wet removal is performed, and temporary electrical service protected by a ground fault circuit interrupter shall be provided.

#### **3.1.2 Safety and Health Procedures**

The Competent Person shall be present on the work site throughout the abatement project to supervise, monitor, and document the project's health and safety provisions. A daily log shall be maintained showing the results of sampling tests throughout the project area.

#### **3.1.3 Safety and Health Responsibilities**

The Competent Person shall:

- a. Verify that training meets applicable requirements.
- b. Review and approve LBP Management Plan for conformance to the applicable referenced standards.
- c. Inspect LBP removal work for conformance with the accepted LBP Management Plan.
- d. Ensure that worker exposure air monitoring activities are in accordance with 29 CFR 1926 Section .62.
- e. Ensure work is performed in strict accordance with specifications.
- f. Ensure hazardous exposure to personnel and to the environment are adequately controlled.

The Competent Person shall be responsible for directing personal sampling.

#### **3.1.4 Medical Surveillance Procedures**

Medical surveillance shall be implemented in accordance with the approved Contractor's LBP Management Plan, and shall comply with the requirements of 29 CFR 1926 Section .62, including the provisions for biological monitoring, medical removal protection and a physician's written opinion, signed by the physician performing the employee examination. The Contractor shall provide a copy of the written opinion for Contractor's employees 2 days prior to each employee's commencement of work.

#### **3.1.5 Engineering Controls and Containment Structures**

##### **3.1.5.1 LBP Control Area**

The LBP control area is where LBP abatement work occurs and as such shall be considered contaminated.

##### **3.1.5.2 Boundary Requirements**

Physical boundaries shall be provided around exterior LBP control areas by roping off the area indicated in the LBP Management Plan. A roped-off

perimeter shall be installed 20 feet from, and around, the area where the LBP handling procedures are performed and other requirements for LBP control areas shall be maintained. Personal monitoring of airborne concentrations shall be conducted in adjacent areas, during the work shift, in accordance with 29 CFR 1926 Section .62.

#### **3.1.5.3 LBP Control Area Exiting Procedures**

Personnel exiting a LBP control area shall perform the following procedures and shall not leave the work place wearing any clothing or equipment worn during the work day:

- a. Vacuum all protective clothing before removing.
- b. Remove protective clothing in the decontamination room, and place this clothing in an approved impermeable disposal bag.
- c. Wash or shower.
- d. Change to clean clothes prior to leaving the physical boundary designated around the lead-contaminated work site.

#### **3.1.6 Temporary Utilities**

Temporary equipment to provide adequate power, light, heat, and water shall be installed to accomplish the abatement operations properly and safely. The Contractor shall maintain the security and maintenance of the utility system in the LBP control areas. In the event of a failure of any utility system, the Government will not be responsible for any loss of time or other expense incurred by the Contractor. Wiring and electrical service shall be as specified in to Section 16415 Electrical Work, Interior or Section 16370 Electrical Distribution System, Aerial. In addition, the Contractor shall provide:

- a. Backflow protection on all water connections. Fittings installed by the Contractor shall be removed after completion of work with no damage or alteration to existing water piping and equipment.
- b. Heavy-duty abrasion-resistant hoses to provide water to each work area and decontamination area.
- c. A hot water heater for showers.
- d. Electrical service to work areas. Electrical service shall comply with NEMA, NECA, and UL standards. Warning signs shall be posted at power outlets which are other than 110-120 volt power. Only grounded extension cords shall be used. Incandescent lamps and light fixtures shall be of adequate wattage to provide good illumination in LBP control areas.
- e. Temporary heating units, when needed, that have been tested and labeled by UL, FM, or another recognized trade association related to the fuel being consumed. Forced air or fan type units shall not be utilized inside a work area. Units shall have tip-over protection.

### **3.2 LBP ABATEMENT METHODS**

#### **3.2.1 Component Replacement**

All painted metal handrails shall be removed from buildings. The Contractor is not required to replace the handrails. All debris shall be handled in accordance with the Hazardous Waste Management Plan.

### **3.3 MONITORING**

During the entire LBP removal and disposal operations, a Competent Person shall be onsite directing the monitoring/sampling and inspecting the work to ensure that the health and safety requirements of this contract are satisfied.

### **3.3.1 Personal Air Monitoring**

Airborne concentrations of lead shall be collected and analyzed in accordance with 29 CFR 1926 Section .62. Results shall be reported in micrograms per cubic meter of air. The Competent Person shall use personal air monitoring results to determine the effectiveness of engineering controls, the adequacy of PPE and to determine if proper work practices are being employed. The Contracting Officer's Representative shall be notified if any personal air monitoring result equals or exceeds 30 micrograms per cubic meter of air. The Contractor shall take steps to reduce the concentration of lead in the air.

### **3.3.2 Waste Sampling and Testing**

Sampling and testing of all waste shall be in accordance with 40 CFR 261.

### **3.4 ADJACENT AREAS**

Damage to adjacent areas shall be repaired to the approval of the Contracting Officer's Representative at no additional cost to the Government.

### **3.5 TESTING**

Lead paint covered handrails will be tested for lead leachability via TCLP test per 29 CFR 261. The results of the TCLP analysis shall be used to determine disposal procedures.

### **3.6 CLEANUP AND DISPOSAL**

#### **3.6.1 Cleanup**

##### **3.6.1.1 Daily**

Surfaces in the LBP control area shall be maintained free of accumulations of paint chips and dust. Spread of dust and debris shall be restricted; waste shall not be distributed over the work area. Dry sweep or compressed air shall not be used for cleanup. At the end of each shift, the area shall be cleaned of visible lead paint contamination by vacuuming with a HEPA filtered vacuum cleaner and wet mopping the area. LBP abatement work shall cease during the cleanup.

##### **3.6.1.2 Prior to Clearance**

Upon completion of the lead paint abatement and a satisfactory visual inspection by the Contracting Officer's Representative in a given work area, a preliminary clean-up shall be performed by the Contractor. This clean-up includes removal of any contaminated material, equipment or debris. The following methodology shall be utilized during the cleanup prior to clearance.

- a. Lead-contaminated debris shall be removed.
- b. Non-contaminated debris shall be containerized; removed from the work area and stored in the designated area until disposal in accordance with paragraph Non-Contaminated Waste.
- c. Cleaning. Cleaning of a 5' diameter circle of surface around the handrail cutting shall be done in the following sequence: HEPA Vacuum; Tri-Sodium Phosphate (TSP) wash (or equivalent cleaner); and HEPA Vacuum.
- d. Cleaning Equipment. The Contractor shall prepare and use detergents containing five to ten percent TSP or other equally effective cleaning agent which shall be used in accordance with the manufacturers instructions. The waste water from cleaning shall be contained and

disposed of according to applicable Federal, state, county and local regulations and guidelines. The waste water shall not be disposed of in storm sewers or sanitary sewers without specific and written Government approval.

### **3.6.2 Visual Inspection**

Upon completion of the final cleaning, the Contractor shall notify the Contracting Officer's Representative and request a final visual inspection with the Contracting Officer's representative with the criteria in the final cleaning/visual inspection example format sheet located at the end of this section. If the area does not pass the visual inspection, the Contractor shall reclean the area as required by paragraph CLEANUP AND DISPOSAL, at no additional expense to the Government. Final clearance testing shall not proceed until the Contracting Officer's Representative has accepted the final cleaning by the Contractor.

### **3.6.3 Certification**

The Competent Person shall certify in writing that inside the LBP control area and the area external to the LBP control area met final clearance requirements.

### **3.6.4 Removal of Control Area**

After approval of the final clearance certification, and when authorized by the Contracting Officer's Representative, the LBP control area, containment barriers, and control structures roped-off boundary and warning signs shall be removed.

### **3.6.5 Disposal**

Disposal of the metal handrails will be based on the results of the TCLP test. If the samples exceed the threshold for lead leachability (5 mg/l), the metal handrails will be considered a hazardous waste if disposed of. See paragraph "Contaminated Waste" below for disposal.

#### **3.6.5.1 Contaminated Waste**

a. If the handrails exceed the threshold for lead leachability, they are considered a hazardous waste IF they are disposed of. Instead, the Contractor shall recycle the handrails as scrap metal per EPA regulation 40 CFR 261.6. Per the regulation, the handrails are recycled if they are reused. Per the AFDTC Plan 19-4, the Contractor will be required to deliver the TCLP test results to the recycler of the handrails and deliver the recycler's acknowledgement to the Government before the item will be released by the Government. Handrails salvaged for recycling by the Contractor will be removed from Government property before completion of the contract and will not be sold on the site.

b. Lead-contaminated waste, scrap, debris, bags, containers, equipment, and lead-contaminated clothing, which may produce airborne concentrations of lead particles shall be stored in U.S. Department of Transportation 49 CFR 178 approved 55 gallon drums. Each drum shall be labeled to identify the type of waste as defined in 49 CFR 172 and the date lead-contaminated wastes were first put into the drum. The Uniform Hazardous Waste Manifest forms from Federal and state agencies shall be obtained and completed. Land disposal restriction notifications shall be as required by 40 CFR 268. The Contracting Officer's Representative shall be notified at least 14 days prior to delivery to arrange for job site inspection of the drums and manifests. Lot deliveries

of hazardous wastes shall be made as needed to ensure that drums do not remain on the work site longer than 90 calendar days from the date affixed to each drum. The Contracting Officer's Representative will assign an area for interim storage of waste-containing drums. Lead-contaminated waste shall be handled, stored, transported, and disposed of in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Land disposal restriction notification shall be as required by 40 CFR 268.

#### **3.6.5.2 Non-Contaminated Waste**

Non-contaminated waste, scrap, and debris shall be disposed of at the any local landfill.

#### **3.6.6 Disposal Documentation**

The Contractor shall complete and provide final completed copies of the Waste Shipment Record for all shipments of waste material as specified in 40 CFR 61, Subpart M including EPA form 8700-22 with Stephen Kauffman, Eglin AFB Environmental Manager, signing as generator. Mr Kauffman can be reached at (904)882-6282, Ext 253 and at AFDTC/EMCW, 501 DeLeon St. Suite 101, Eglin AFB, FL 32542-5133. Detailed information of all other required state waste manifest shipment records within 3 days of delivery to the landfill. Written evidence shall be provided that the hazardous waste treatment, storage, or disposal facility is approved for lead disposal by the EPA and state or local regulatory agencies. One copy shall be submitted of the completed manifest; signed, and dated by the initial transporter in accordance with 40 CFR 262.

#### **3.6.7 Title to Materials**

Materials resulting from demolition work, except as specified otherwise, shall become the property of the Contractor, and shall be disposed of in accordance with Section 02072 REMOVAL WORK, except as specified herein.

#### **3.6.8 Payment for Hazardous Waste**

Payment for disposal of hazardous waste will not be made until a signed copy of the manifest from the treatment or disposal facility certifying the amount of lead-containing materials delivered is returned and a copy is furnished to the Government.

CERTIFICATION OF FINAL CLEANING AND VISUAL INSPECTION

Individual abatement task as identified in paragraph,  
Description of Work\_\_\_\_\_

In accordance with the clearing and decontamination procedures specified in the Contractor's lead hazard abatement plan and this contract, the Contractor hereby certifies that he/she has thoroughly visually inspected the decontaminated regulated work area (all surfaces, including pipes, beams, ledges, walls, ceiling, floor, decontamination unit, etc.) and has found no dust, debris, or lead containing material residue.

BY: (Contractor's signature)\_\_\_\_\_

Date\_\_\_\_\_

Print name and

title\_\_\_\_\_

(Contractor's Onsite Supervisor signature)\_\_\_\_\_

Date\_\_\_\_\_

Print name and

title\_\_\_\_\_

(Contractor's Competent Person signature)\_\_\_\_\_ Date\_\_\_\_\_

Print name and

title\_\_\_\_\_

CONTRACTING OFFICER'S REPRESENTATIVE ACCEPTANCE OR REJECTION

The Contracting Officer's Representative hereby determines that the Contractor has performed final cleaning and visual inspection of the decontaminated regulated work area (all surfaces including pipes, beams, ledges, walls, ceiling, floor, decontamination unit, etc.) and by quality assurance inspection, finds the Contractor's final cleaning to be:

\_\_\_\_\_ Acceptable

\_\_\_\_\_ Unacceptable, Contractor instructed to reclean the LBP control work area

BY: Contracting Officer's Representative

Signature\_\_\_\_\_

Date\_\_\_\_\_

Print name and

title\_\_\_\_\_

--End of Section--

## **SECTION 02210**

### **GRADING**

#### **PART 1 GENERAL**

##### **1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

##### **AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

ASTM D 1556	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

##### **1.2 DEFINITIONS**

###### **1.2.1 Satisfactory Materials**

Materials classified in ASTM D 2487 as GW, GP, and SW, and free from roots and other organic matter, trash, debris, and frozen materials and stones larger than 6 inches in any dimension are satisfactory.

###### **1.2.2 Unsatisfactory Materials**

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Materials classified in ASTM D 2487 as Pt, OH, and OL are unsatisfactory. Unsatisfactory materials also include man-made fills, refuse, or backfills from previous construction.

###### **1.2.3 Cohesionless and Cohesive Materials**

Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Materials classified as GM and SM will be identified as cohesionless only when the fines have a plasticity index of zero.

#### **1.2.4 Degree of Compaction**

Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated below as a percent of laboratory maximum density.

#### **1.2.5 Overhaul**

Overhaul is the authorized transportation of satisfactory excavation or borrow materials in excess of the free-haul limit of \_\_\_\_\_ stations. Overhaul is the product of the quantity of materials hauled beyond the free-haul limit and the distance such materials are hauled beyond the free-haul limit, expressed in station yards.

### **1.3 BORROW MATERIAL**

Borrow material shall be selected to meet requirements and conditions of the particular fill for which it is to be used. Necessary clearing, grubbing, disposal of debris, and satisfactory drainage of borrow pits shall be performed by the Contractor as incidental operations to the borrow excavation.

#### **1.3.1 Selection**

The source of borrow material shall be the Contractor's responsibility. Unless otherwise provided in the contract, the contractor shall obtain from the owners the right to procure material, shall pay all royalties and other chargers involved, and shall bear all the expense of developing the sources, including rights-of-way for hauling.

## **PART 2 EXECUTION**

### **2.1 CONSERVATION OF TOPSOIL**

Where indicated, topsoil shall be removed to a depth of 4 inches without contamination with subsoil and stockpiled convenient to areas for later application or at locations specified. Topsoil shall be removed to full depth and shall be stored separate from other excavated materials and piled free of roots, stones, and other undesirable materials. Any surplus of topsoil from excavations and grading shall be removed from the site.

### **2.2 EXCAVATION**

After topsoil removal has been completed, excavation of every description, regardless of material encountered, within the grading limits of the project shall be performed to the lines and grades indicated. Satisfactory excavation material shall be transported to and placed in fill areas within the limits of the work. All unsatisfactory material and surplus material shall be removed from site.

### **2.3 BACKFILL ADJACENT TO STRUCTURES**

Backfill adjacent to structures shall be placed and compacted uniformly in such manner as to prevent wedging action or eccentric loading upon or against the structures. Slopes bounding or within areas to be backfilled shall be stepped or serrated to prevent sliding of the fill. During backfilling operations and in the formation of embankments, equipment that will overload the structure in passing over and compacting these fills shall not be used.



Backfill for storm drains and subdrains, including the bedding and backfill for structures other than culverts and drains, shall conform to the additional requirements in other applicable sections.

#### **2.4 FINISHED EXCAVATION, FILLS, AND EMBANKMENTS**

All areas covered by the project, including excavated and filled sections and adjacent transition areas, shall be uniformly smooth-graded. The finished surface shall be reasonably smooth, compacted, and free from irregular surface changes. The degree of finish shall be that ordinarily obtainable from blade-grader operations, except as otherwise specified. Ditches and gutters shall be finished to permit adequate drainage. The surface of areas to be turfed shall be finished to a smoothness suitable for the application of turfing materials. For subgrade areas to be paved, the following shall be accomplished as required: (a) soft or otherwise unsatisfactory material shall be replaced with satisfactory excavated material or other approved materials; (b) low areas resulting from removal of unsatisfactory material or from excavation of rock shall be brought up to required grade with satisfactory materials, and the entire subgrade shall be shaped to line, grade, and cross section and shall be compacted as specified. Surfaces other than those that are to be paved shall be finished not more than 0.15 foot above or below the established grade or approved cross section.

#### **2.5 PLACING TOPSOIL**

On areas to receive topsoil, the compacted subgrade soil shall be scarified to a 2 inch depth for bonding of topsoil with subsoil. Topsoil then shall be spread evenly to a thickness of 4 inches and graded to the elevations and slopes shown. Topsoil shall not be spread when frozen or excessively wet or dry. Material required for topsoil in excess of that produced by excavation within the grading limits shall be obtained from off-site areas.

#### **2.6 PROTECTION**

Newly graded areas shall be protected from traffic and from erosion, and any settlement or washing away that may occur from any cause, prior to acceptance, shall be repaired and grades reestablished to the required elevations and slopes. All work shall be conducted in accordance with the environmental protection requirements of the contract.

--End of Section--

## SECTION 02222

### EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS

#### **PART 1 GENERAL**

##### **1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

##### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 422	(1963; R 1990) Particle-Size Analysis of Soils
ASTM D 1556	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2487	(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)

##### **1.2 DEFINITIONS**

###### **1.2.1 Degree of Compaction**

Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557.

#### **PART 2 PRODUCTS**

##### **2.1 MATERIALS**

###### **2.1.1 Satisfactory Materials**

Satisfactory materials shall consist of any material classified by ASTM D 2487 as GM, SP, SM, GW, GP, and SW.

###### **2.1.2 Unsatisfactory Materials**

Unsatisfactory materials shall be materials that do not comply with the requirements for satisfactory materials. Unsatisfactory materials include but are not limited to those materials containing roots and other organic matter, trash, debris, frozen materials and stones larger than 2 inches, and materials classified in ASTM D 2487, as MH, ML, GC, SC, CL, CH, PT, OH, and OL. Unsatisfactory materials also include man-made fills, refuse, or backfills from previous construction.

###### **2.1.3 Cohesionless and Cohesive Materials**

Cohesionless materials shall include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic.

#### **2.1.4 Unstable Material**

Unstable material shall consist of materials too wet to properly support the utility pipe, conduit, or appurtenant structure.

#### **2.1.5 Select Granular Material**

Select granular material shall consist of well-graded sand, gravel, crushed gravel, crushed stone or crushed slag composed of hard, tough and durable particles, and shall contain not more than 10 percent by weight of material passing a No. 200 mesh sieve and no less than 95 percent by weight passing the 1 inch sieve. The maximum allowable aggregate size shall be 1-1/2 inches, or the maximum size recommended by the pipe manufacturer, whichever is smaller.

#### **2.1.6 Initial Backfill Material**

Initial backfill shall consist of select granular material or satisfactory materials free from rocks 2 inches or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller.

#### **2.1.7 Plastic Marking Tape**

Plastic marking tape shall be acid and alkali-resistant polyethylene film, 6 inches wide with minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified in TABLE 1 and shall bear a continuous printed inscription describing the specific utility.

TABLE 1. Tape Color

Red:	Electric
Yellow:	Gas, Oil, Dangerous Materials
Orange:	Telephone, Telegraph, Television, Police, and Fire Communications
Blue:	Water Systems
Green:	Sewer Systems

### **PART 3 EXECUTION**

#### **3.1 EXCAVATION**

Excavation shall be performed to the lines and grades indicated. Rock excavation shall include removal and disposition of material defined as rock in paragraph MATERIALS. Earth excavation shall include removal and disposal of material not classified as rock excavation. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench equal to 1/2 the depth of the excavation, but in no instance closer than 2 feet. Excavated material not required or not satisfactory for backfill shall be removed from the site and be disposed of off base. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating

therein shall be removed to maintain the stability of the bottom and sides of the excavation. Unauthorized overexcavation shall be backfilled in accordance with paragraph BACKFILLING AND COMPACTION at no additional cost to the Government.

### **3.1.1 Trench Excavation**

The trench shall be excavated as recommended by the manufacturer of the pipe to be installed. Trench walls below the top of the pipe shall be sloped, or made vertical, and of such width as recommended in the manufacturer's installation manual. Where no manufacturer's installation manual is available, trench walls shall be made vertical. Trench walls more than 4 feet high shall be shored, cut back to a stable slope, or provided with equivalent means of protection for employees who may be exposed to moving ground or cave in. Vertical trench walls more than 4 feet high shall be shored. Trench walls which are cut back shall be excavated to at least the angle of repose of the soil. Special attention shall be given to slopes which may be adversely affected by weather or moisture content. The trench width below the top of pipe shall not exceed 24 inches plus pipe outside diameter (O.D.) for pipes of less than 24 inches inside diameter and shall not exceed 36 inches plus pipe outside diameter for sizes larger than 24 inches inside diameter. Where recommended trench widths are exceeded, redesign, stronger pipe, or special installation procedures shall be utilized by the Contractor. The cost of redesign, stronger pipe, or special installation procedures shall be borne by the Contractor without any additional cost to the Government.

#### **3.1.1.1 Bottom Preparation**

The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 2 inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

#### **3.1.1.2 Removal of Unstable Material**

Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with select granular material as provided in paragraph BACKFILLING AND COMPACTION. When removal of unstable material is required due to the fault or neglect of the Contractor in his performance of the work, the resulting material shall be excavated and replaced by the Contractor without additional cost to the Government.

#### **3.1.1.3 Stockpiles**

Stockpiles of satisfactory and unsatisfactory shall be placed and graded as specified. Stockpiles shall be kept in a neat and well drained condition, giving due consideration to drainage at all times. The ground surface at stockpile locations shall be cleared, grubbed, and sealed by rubber-tired equipment, excavated satisfactory and unsatisfactory materials shall be separately stockpiled. Stockpiles of satisfactory materials shall be protected from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, such material shall be removed and

replaced with satisfactory material from approved sources at no additional cost to the Government. Locations of stockpiles of satisfactory materials shall be subject to prior approval of the Contracting Officer.

### **3.2 BACKFILLING AND COMPACTION**

Backfill material shall consist of satisfactory material, select granular material, or initial backfill material as required. Backfill shall be placed in layers not exceeding 4 inches loose thickness for compaction by hand operated machine compactors, and 8 inches loose thickness for other than hand operated machines, unless otherwise specified. Each layer shall be compacted to at least 95 percent maximum density for cohesionless soils and 90 percent maximum density for cohesive soils, unless otherwise specified.

#### **3.2.1 Trench Backfill**

The trench shall be backfilled to 2 feet above the top of pipe prior to performing the required pressure tests. The joints and couplings shall be left uncovered during the pressure test. The trench shall not be backfilled until all specified tests are performed.

##### **3.2.1.1 Replacement of Unstable Material**

Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 6 inches loose thickness.

##### **3.2.1.2 Bedding and Initial Backfill**

Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe.

##### **3.2.1.3 Final Backfill**

The remainder of the trench shall be filled with satisfactory material. Backfill material shall be placed and compacted as follows:

- a. Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas: Backfill shall be deposited in layers of a maximum of 12 inch loose thickness, and compacted to 85 percent maximum density for cohesive soils and 90 percent maximum density for cohesionless soils. Compaction by water flooding or jetting will not be permitted. This requirement shall also apply to all other areas not specifically designated above.

### **3.3 SPECIAL REQUIREMENTS**

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

#### **3.3.1 Gas Distribution**

Trenches shall be excavated to a depth that will provide not less than 24 inches of cover. Trenches shall be graded as specified for pipe-laying requirements in Section 02685 GAS DISTRIBUTION SYSTEM.

### **3.3.2 Water Lines**

Trenches shall be of a depth to provide a minimum cover of 3 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe. For fire protection yard mains or piping, an additional 12 inches of cover is required.

### **3.3.3 Electrical Distribution System**

Direct burial cable and conduit or duct line shall have a minimum cover of 24 inches from the finished grade, unless otherwise indicated. Special trenching requirements for direct-burial electrical cables and conduits are specified in Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

### **3.3.4 Plastic Marking Tape**

Warning tapes shall be installed directly above the pipe, at a depth of 18 inches below finished grade unless otherwise shown.

## **3.4 TESTING**

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government.

### **3.4.1 Testing Facilities**

Tests shall be performed by an approved commercial testing laboratory or may be tested by facilities furnished by the Contractor. No work requiring testing will be permitted until the facilities have been inspected and approved by the Contracting Officer. The first inspection shall be at the expense of the Government. Cost incurred for any subsequent inspection required because of failure of the first inspection will be charged to the Contractor.

### **3.4.2 Testing of Backfill Materials**

Characteristics of backfill materials shall be determined in accordance with particle size analysis of soils ASTM D 422 and moisture-density relations of soils ASTM D 1557. A minimum of one particle size analysis and one moisture-density relation test shall be performed on each different type of material used for bedding and backfill.

### **3.4.3 Field Density Tests**

Tests shall be performed in sufficient numbers to ensure that the specified density is being obtained. A minimum of one field density test per lift of backfill for every 100 feet of installation shall be performed. One moisture density relationship shall be determined for every 1500 cubic yards of material used. Field in-place density shall be determined in accordance with ASTM D 1556. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job, on each different type of material encountered, at intervals as directed by the Contracting Officer. Copies of calibration curves, results of calibration tests, and field and laboratory density tests shall be furnished to the Contracting Officer. Trenches improperly compacted shall be reopened to the depth directed, then refilled and compacted to the density specified at no additional cost to the Government.

#### **3.4.4 Displacement of Sewers**

After other required tests have been performed and the trench backfill compacted to the finished grade surface, the pipe shall be inspected to determine whether significant displacement has occurred. This inspection shall be conducted in the presence of the Contracting Officer. Pipe sizes larger than 36 inches shall be entered and examined, while smaller diameter pipe shall be inspected by shining a light or laser between manholes or manhole locations, or by the use of television cameras passed through the pipe. If, in the judgement of the Contracting Officer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, the defects shall be remedied as directed at no additional cost to the Government.

--End of Section--

## SECTION 02511

### CONCRETE SIDEWALKS AND CURBS AND GUTTERS

#### PART I. GENERAL

##### 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO M 182 (1991) Burlap Cloth Made from Jute or Kenaf

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 185 (1990a) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement

ASTM A 615 (1990) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

ASTM A 616 (1990) Rail-Steel Deformed and Plain Bars for Concrete Reinforcement

ASTM A 617 (1990) Axle-Steel Deformed and Plain Bars for Concrete Reinforcement

ASTM C 31 (1991) Making and Curing Concrete Test Specimens in the Field

ASTM C 143 (1990a) Slump of Hydraulic Cement Concrete

ASTM C 171 (1991) Sheet Materials for Curing Concrete

ASTM C 172 (1990) Sampling Freshly Mixed Concrete

ASTM C 173 (1978) Air Content of Freshly Mixed Concrete by the Volumetric Method

ASTM C 231 (1991b) Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C 309 (1991) Liquid Membrane-Forming Compounds for Curing Concrete

ASTM D 1751 (1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction  
(Nonextruding and Resilient Bituminous Types)

ASTM D 1752 (1984; R 1992) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

ASTM D 3405 (1994) Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements



CORPS OF ENGINEERS (COE)

COE CRD-C 527

(1988) Standard Specification for Joint Sealants, Cold-Applied, Non-Jet-Fuel-Resistant, for Rigid and Flexible Pavements

**1.2 WEATHER LIMITATIONS**

**1.2.1 Placing During Cold Weather**

Concrete placement shall be discontinued when the air temperature reaches 40 degrees F and is falling. Placement may begin when the air temperature reaches 35 degrees F and is rising. Provisions shall be made to protect the concrete from freezing during the specified curing period. If necessary to place concrete when the temperature of the air, aggregates, or water is below 35 degrees F, placement shall be approved in writing. Approval shall be contingent upon full conformance with the following provisions. The underlying material shall be prepared and protected so that it is entirely free of frost when the concrete is deposited. Mixing water and aggregates shall be heated as necessary to result in the temperature of the in-place concrete being between 50 and 85 degrees F. Methods and equipment for heating shall be approved. The aggregates shall be free of ice, snow, and frozen lumps before entering the mixer. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period.

**1.2.2 Placing During Warm Weather**

The temperature of the concrete as placed shall not exceed 85 degrees F except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. In no case shall the placing temperature exceed 95 degrees F.

**1.3 PLANT, EQUIPMENT, MACHINES, AND TOOLS**

**1.3.1 General Requirements**

Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times. The equipment shall have the capability of producing the required product, meeting grade controls, thickness control and smoothness requirements as specified. Use of the equipment shall be discontinued if it produces unsatisfactory results. The Contracting Officer shall have access at all times to the plant and equipment to ensure proper operation and compliance with specifications.

**1.3.2 Slip Form Equipment**

Slip form paver or curb forming machine, will be approved based on trial use on the job and shall be self-propelled, automatically controlled, crawler mounted, and capable of spreading, consolidating, and shaping the plastic concrete to the desired cross section in one pass.

**PART 2. PRODUCTS**

**2.1 CONCRETE**

Concrete shall have a minimum compressive strength of 3500 psi at 28 days. Maximum size of aggregate shall be 1-1/2 inches.

### **2.1.1 Air Content**

Mixtures shall may have air content by volume of concrete of 5 to 7 percent, based on measurements made immediately after discharge from the mixer.

### **2.1.2 Slump**

The concrete slump shall be 4 inches where determined in accordance with ASTM C 143.

### **2.1.3 Reinforcement Steel**

Reinforcement bars shall conform to ASTM A 615, ASTM A 616, or ASTM A 617. Wire mesh reinforcement shall conform to ASTM A 185.

## **2.2 CONCRETE CURING MATERIALS**

### **2.2.1 Impervious Sheet Materials**

Impervious sheet materials shall conform to ASTM C 171, type optional, except that polyethylene film, if used, shall be white opaque.

### **2.2.2 Burlap**

Burlap shall conform to AASHTO M 182.

### **2.2.3 White Pigmented Membrane-Forming Curing Compound**

White pigmented membrane-forming curing compound shall conform to ASTM C 309, Type 2.

## **2.3 CONCRETE PROTECTION MATERIALS**

Concrete protection materials shall be a linseed oil mixture of equal parts, by volume, of linseed oil and either mineral spirits, naphtha, or turpentine. At the option of the contractor, commercially prepared linseed oil mixtures, formulated specifically for application to concrete to provide protection against the action of deicing chemicals may be used, except that emulsified mixtures are not acceptable.

## **2.4 JOINT FILLER STRIPS**

### **2.4.1 Contraction Joint Filler for Curb and Gutter**

Contraction joint filler for curb and gutter shall consist of hard-pressed fiberboard.

### **2.4.2 Expansion Joint Filler, Premolded**

Expansion joint filler, premolded, shall conform to ASTM D 1751 or ASTM D 1752, 3/8 inch thick, unless otherwise indicated.

## **2.5 JOINT SEALANTS**

### **2.5.1 Joint Sealant, Cold-Applied**

Joint sealant, cold-applied shall conform to COE CRD-C 527.

### **2.5.2 Joint Sealant, Hot-Poured**

Joint sealant, hot-poured shall conform to ASTM D 3405.

### **2.6 FORM WORK**

Form work shall be designed and constructed to insure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified. Forms shall be of wood or steel, straight, of sufficient strength to resist springing during depositing and consolidating concrete. Wood forms shall be surfaced plank, 2-inch nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Wood forms shall have a nominal length of 10 feet. Radius bends may be formed with 3/4-inch boards, laminated to the required thickness. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Ends of steel forms shall be interlocking and self-aligning. Steel forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. Steel forms shall have a nominal length of 10 feet with a minimum of two welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips designed for use with steel forms.

#### **2.6.1 Sidewalk Forms**

Sidewalk forms shall be of a height equal to the full depth of the finished sidewalk.

#### **2.6.2 Curb and Gutter Forms**

Curb and gutter outside forms shall have a height equal to the full depth of the curb or gutter. The inside form of curb shall have batter as indicated and shall be securely fastened to and supported by the outside form. Rigid forms shall be provided for curb returns, except that benders or thin plank forms may be used for curb or curb returns with a radius of 10 feet or more, where grade changes occur in the return, or where the central angle is such that a rigid form with a central angle of 90 degrees cannot be used. Back forms for curb returns may be made of 1-1/2 inch benders, for the full height of the curb, cleated together.

### **PART 3 EXECUTION**

#### **3.1 SUBGRADE PREPARATION**

The subgrade shall be constructed to the specified grade and cross section prior to concrete placement.

##### **3.1.1 Sidewalk Subgrade**

The subgrade shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.

##### **3.1.2 Curb and Gutter Subgrade**

Subgrade shall be placed and compacted to modified subgrade 6" thick 95 degrees max density.

##### **3.1.3 Maintenance of Subgrade**

The subgrade shall be maintained in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. The subgrade shall be in a moist condition when concrete is

placed. The subgrade shall be prepared and protected so as to produce a subgrade free from frost when the concrete is deposited.

### **3.2 FORM SETTING**

Forms shall be carefully set to the indicated alignment, grade and dimensions. Forms shall be held rigidly in place by a minimum of three stakes per form placed at intervals not to exceed 4 feet. Corners, deep sections, and radius bends shall have additional stakes and braces, as required. Clamps, spreaders, and braces shall be used where required to insure rigidity in the forms. Forms shall be removed without injuring the concrete. Bars or heavy tools shall not be used against the concrete in removing the forms. Any concrete found defective after form removal shall be promptly and satisfactorily repaired. Forms shall be cleaned and coated with form oil each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory.

#### **3.2.1 Sidewalks**

Forms for sidewalks shall be set with the upper edge true to line and grade with an allowable tolerance of 1/8 inch in any 10-foot long section. After forms are set, grade and alignment shall be checked with a 10-foot straightedge. Forms shall have a transverse slope 1/4-inch per foot with the low side adjacent to the roadway. Side forms shall not be removed for 12 hours after finishing has been completed.

#### **3.2.2 Curbs and Gutters**

The forms of the front of the curb shall be removed not less than 2 hours nor more than 6 hours after the concrete has been placed. Forms back of curb shall remain in place until the face and top of the curb have been finished as specified for concrete finishing. Gutter forms shall not be removed while the concrete is sufficiently plastic to slump in any direction.

### **3.3 SIDEWALK CONCRETE PLACEMENT AND FINISHING**

#### **3.3.1 Formed Sidewalks**

Concrete shall be placed in the forms in one layer of such thickness that when consolidated and finished the sidewalks will be of the thickness indicated. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted. The concrete shall be consolidated with an approved vibrator, and the surface shall be finished to grade with a wood float, bull float, or darby, edged and broom finished.

#### **3.3.2 Concrete Finishing**

After straightedging, when most of the water sheen has disappeared, and just before the concrete hardens, the surface shall be finished to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A scored surface shall be produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic.

#### **3.3.3 Edge and Joint Finishing**

All slab edges, including those at formed joints, shall be finished carefully with an edger having a radius of 1/8 inch. Transverse joint shall be edged before brooming, and the brooming shall eliminate the flat surface left by the

surface face of the edger. Corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished.

#### **3.3.4 Surface and Thickness Tolerances**

Finished surfaces shall not vary more than 1/4 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

### **3.4 CURB AND GUTTER CONCRETE PLACEMENT AND FINISHING**

#### **3.4.1 Formed Curb and Gutter**

Concrete shall be placed to the section required in a single lift. Consolidation shall be achieved by using approved mechanical vibrators.

#### **3.4.2 Concrete Finishing**

Exposed surfaces shall be floated and finished with a smooth wood float until true to grade and section and uniform in texture. Floated surfaces shall then be brushed with a fine-hair brush with longitudinal strokes. The edges of the gutter and top of the curb shall be rounded with an edging tool to a radius of 1/2 inch. Immediately after removing the front curb form, the face of the curb shall be rubbed with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. The front curb surface, while still wet, shall be brushed in the same manner as the gutter and curb top. The top surface of gutter and entrance shall be finished to grade with a wood float.

#### **3.4.3 Joint Finishing**

Curb edges at formed joints shall be finished as indicated.

#### **3.4.4 Surface and Thickness Tolerances**

Finished surfaces shall not vary more than 1/4 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

### **3.5 SIDEWALK JOINTS**

Sidewalk joints shall be constructed to divide the surface into rectangular areas. Transverse contraction joints shall be spaced at a distance equal to the sidewalk width or 5 feet on centers, whichever is less, and shall be continuous across the slab. Longitudinal contraction joints shall be constructed along the centerline of all sidewalks 10 feet or more in width. Transverse expansion joints shall be installed at sidewalk returns and opposite expansion joints in adjoining curbs. Where the sidewalk is not in contact with the curb, transverse expansion joints shall be installed as indicated. Expansion joints shall be formed about structures and features which project through or into the sidewalk pavement, using joint filler of the type, thickness, and width indicated.

#### **3.5.1 Contraction Joints**

The contraction joints shall be formed in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness, using a jointer to cut the groove, or by sawing a groove in the hardened concrete with a power-driven saw, unless otherwise approved. Sawed joints shall be constructed by sawing a groove in the concrete with a 1/8-inch blade to the depth indicated. An ample supply of saw

blades shall be available on the job before concrete placement is started, and at least one standby sawing unit in good working order shall be available at the jobsite at all times during the sawing operations.

### **3.5.2        Expansion Joints**

Expansion joints shall be formed with 1/2 inch joint filler strips. Joint filler shall be placed with top edge 1/4 inch below the surface and shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing. Immediately after finishing operations are completed, joint edges shall be rounded with an edging tool having a radius of 1/8 inch, and concrete over the joint filler shall be removed. At the end of the curing period, expansion joints shall be carefully cleaned and filled with joint sealer.

The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing shall be done so that the material will not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 50 degrees F at the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

### **3.5.3        Reinforcement Steel Placement**

Reinforcement steel shall be accurately and securely fastened in place with suitable supports and ties before the concrete is placed.

## **3.6        CURB AND GUTTER JOINTS**

Curb and gutter joints shall be constructed at right angles to the line of curb and gutter.

### **3.6.1        Contraction Joints**

Contraction joints shall be constructed directly opposite contraction joints in abutting portland cement concrete pavements and spaced so that monolithic sections between curb returns will not be less than 5 feet nor greater than 15 feet in length. Contraction joints shall be constructed by means of 1/8-inch thick separators and of a section conforming to the cross section of the curb and gutter. Separators shall be removed as soon as practicable after concrete has set sufficiently to preserve the width and shape of the joint and prior to finishing.

### **3.6.2        Expansion Joints**

Expansion joints shall be formed by means of preformed expansion joint filler material cut and shaped to the cross section of curb and gutter. Expansion joints shall be provided in curb and gutter directly opposite expansion joints of abutting portland cement concrete pavement, and shall be of the same type and thickness as joints in the pavement. Where curb and gutter do not abut portland cement concrete pavement, expansion joints at least 1/2 inch in width shall be provided at intervals not exceeding 30 feet. Expansion joints shall be provided in nonreinforced concrete gutter at locations indicated. Expansion joints shall be sealed immediately following curing of the concrete or as soon thereafter as weather conditions permit.

Expansion joints and the top 1-inch depth of curb and gutter contraction-joints shall be sealed with joint sealer. The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing shall be done so that the material will not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and

concrete temperatures shall be above 50 degrees F at the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

### **3.7 CURING AND PROTECTION**

#### **3.7.1 General Requirements**

Concrete shall be protected against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation. Unhardened concrete shall be protected from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready for use before actual concrete placement begins. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

##### **3.7.1.1 Mat Method**

The entire exposed surface shall be covered with two or more layers of burlap. Mats shall overlap each other at least 6 inches. The mat shall be thoroughly wetted with water prior to placing on concrete surface and shall be kept continuously in a saturated condition and in intimate contact with concrete for not less than 7 days.

##### **3.7.1.2 Impervious Sheeting Method**

The entire exposed surface shall be wetted with a fine spray of water and then covered with impervious sheeting material. Sheets shall be laid directly on the concrete surface with the light-colored side up and overlapped 12 inches when a continuous sheet is not used. The curing medium shall not be less than 18-inches wider than the concrete surface to be cured, and shall be securely weighted down by heavy wood planks, or a bank of moist earth placed along edges and laps in the sheets. Sheets shall be satisfactorily repaired or replaced if torn or otherwise damaged during curing. The curing medium shall remain on the concrete surface to be cured for not less than 7 days.

##### **3.7.1.3 Membrane Curing Method**

A uniform coating of white-pigmented membrane-curing compound shall be applied to the entire exposed surface of the concrete as soon after finishing as the free water has disappeared from the finished surface. Formed surfaces shall be coated immediately after the forms are removed and in no case longer than 1 hour after the removal of forms. Concrete shall not be allowed to dry before the application of the membrane. If any drying has occurred, the surface of the concrete shall be moistened with a fine spray of water and the curing compound applied as soon as the free water disappears. Curing compound shall be applied in two coats by hand-operated pressure sprayers at a coverage of approximately 200 square feet per gallon for both coats. The second coat shall be applied in a direction approximately at right angles to the direction of application of the first coat. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. If pinholes, abrasion, or other discontinuities exist, an additional coat shall be applied to the affected areas within 30 minutes. Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified above. Areas where the curing compound is damaged by subsequent construction operations within the curing period shall be resprayed. Necessary precautions shall be taken to insure that the concrete is properly cured at sawed joints, and that no curing compound enters the joints. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed before the concrete in the region of the joint is resprayed with curing compound. The method used for sealing the

joint groove shall prevent loss of moisture from the joint during the entire specified curing period. Approved standby facilities for curing concrete pavement shall be provided at a location accessible to the jobsite for use in the event of mechanical failure of the spraying equipment or other conditions that might prevent correct application of the membrane-curing compound at the proper time. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from any other possible damage to the continuity of the membrane.

### **3.7.2 Backfilling**

After curing, debris shall be removed and the area adjoining the concrete shall be backfilled, graded, and compacted to conform to the surrounding area in accordance with lines and grades indicated.

### **3.7.3 Protection**

Completed concrete shall be protected from damage until accepted. The Contractor shall repair damaged concrete and clean concrete discolored during construction. Concrete that is damaged shall be removed and reconstructed for the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Removed damaged portions shall be disposed of as directed.

### **3.7.4 Protective Coating**

Protective coating of linseed oil mixture shall be applied to the exposed-to-view concrete surface.

#### **3.7.4.1 Application**

Curing and backfilling operation shall be completed prior to applying protective coating. Concrete shall be surface dry and thoroughly clean before each application. Coverage shall be not more than 50 square yards per gallon for first application and not more than 70 square yards per gallon for second application, except that the number of applications and coverage for each application for commercially prepared mixture shall be in accordance with the manufacturer's instructions. Coated surfaces shall be protected from vehicular and pedestrian traffic until dry.

#### **3.7.4.2 Precautions**

Protective coating shall not be heated by direct application of flame or electrical heaters and shall be protected from exposure to open flame, sparks, and fire adjacent to open containers or applicators. Material shall not be applied at temperatures lower than 50 degrees F.

## **3.8 FIELD QUALITY CONTROL**

### **3.8.1 General Requirements**

The Contractor shall perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing. Based upon the results of these inspections and tests, the Contractor shall take the action and submit reports as required below, and any additional tests to insure that the requirements of these specifications are met.



### **3.8.2 Concrete Testing**

#### **3.8.2.1 Strength Testing**

The Contractor shall provide molded concrete specimens for strength tests. Samples of concrete placed each day shall be taken not less than once a day nor less than once for every 250 cubic yards of concrete. The samples for strength tests shall be taken in accordance with ASTM C 172. Cylinders for acceptance shall be molded in conformance with ASTM C 31 by an approved testing laboratory. Each strength test result shall be the average of two test cylinders from the same concrete sample tested at 28 days, unless otherwise specified or approved. Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength, and no individual strength test result falls below the specified strength by more than 500 psi.

#### **3.8.2.2 Air Content**

Air content shall be determined in accordance with ASTM C 173 or ASTM C 231. ASTM C 231 shall be used with concretes and mortars made with relatively dense natural aggregates. Two tests for air content shall be made on randomly selected batches of each class of concrete placed during each shift. Additional tests shall be made when excessive variation in concrete workability is reported by the placing foreman or the Government inspector. If results are out of tolerance, the placing foreman shall be notified and he shall take appropriate action to have the air content corrected at the plant. Additional tests for air content will be performed on each truckload of material until such time as the air content is within the tolerance specified.

#### **3.8.2.3 Slump Test**

Two slump tests shall be made on randomly selected batches of each class of concrete for every 250 cubic yards, or fraction thereof, of concrete placed during each shift. Additional tests will be performed when excessive variation in the workability of the concrete is noted or when excessive crumbling or slumping is noticed along the edges of slip-formed concrete.

### **3.8.3 Thickness Evaluation**

The anticipated thickness of the concrete shall be determined prior to placement by passing a template through the formed section or by measuring the depth of opening of the extrusion template of the curb forming machine. If a slip form paver is used for sidewalk placement, the subgrade shall be true to grade prior to concrete placement and the thickness will be determined by measuring each edge of the completed slab.

### **3.8.4 Surface Evaluation**

The finished surface of each category of the completed work shall be uniform in color and free of blemishes and form or tool marks.

## **3.9 SURFACE DEFICIENCIES AND CORRECTIONS**

### **3.9.1 Thickness Deficiency**

When measurements indicate that the completed concrete section is deficient in thickness by more than 1/4 inch the deficient section will be removed, between regularly scheduled joints, and replaced.

### **3.9.2 High Areas**

In areas not meeting surface smoothness and plan grade requirements, high areas shall be reduced either by rubbing the freshly finished concrete with carborundum brick and water when the concrete is less than 36 hours old or by grinding the hardened concrete with an approved surface grinding machine after the concrete is 36 hours old or more. The area corrected by grinding the surface of the hardened concrete shall not exceed 5 percent of the area of any integral slab, and the depth of grinding shall not exceed 1/4 inch. All pavement areas requiring grade or surface smoothness corrections in excess of the limits specified above shall be removed and replaced.

### **3.9.3 Appearance**

Exposed surfaces of the finished work will be inspected by the Government and any deficiencies in appearance will be identified. Areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the work shall be removed and replaced.

--End of Section--

## SECTION 02685

### GAS DISTRIBUTION SYSTEM

#### **PART 1 GENERAL**

##### **1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

##### AMERICAN GAS ASSOCIATION (AGA)

AGA-01 (1989) A.G.A. Plastic Pipe Manual for Gas Service

##### AMERICAN PETROLEUM INSTITUTE (API)

API Spec 5L (1995) Line Pipe

API Spec 6D (1994) Specification for Pipeline Valves, (Gate, Plug, Ball, and Check Valves)

##### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53 (1993a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

ASTM A 181 (1994) Forgings, Carbon Steel, for General-Purpose Piping

ASTM D 2513 (1993) Thermoplastic Gas Pressure Pipe, Tubing, and Fittings

ASTM D 2683 (1993) Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing

ASTM D 3261 (1993) Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

ASTM D 3308 (1991a) PTFE Resin Skived Tape

ASTM D 3350 (1993) Polyethylene Plastics Pipe and Fittings Materials

##### AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.20.1 (1983; R 1992) Pipe Threads, General Purpose (Inch)

ASME B16.5 (1988; Errata Oct 1988; B16.5a) Pipe Flanges and Flanged Fittings

ASME B16.9 (1993) Factory-Made Wrought Steel Buttwelding Fittings

ASME B16.11 (1991) Forged Fittings, Socket-Welding and Threaded

ASME B16.21 (1992) Nonmetallic Flat Gaskets for Pipe Flanges

ASME B16.40 (1985) Manually Operated Thermoplastic Gas Shutoffs and Valves in Gas Distribution Systems

ASME B31.8	(1992; B31.8a; B31.8b) Gas Transmission and Distribution Piping Systems
ASME BPV VIII Div 1	(1992; Addenda Dec 1992, Dec 1993, Dec 1994) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage
CODE OF FEDERAL REGULATIONS (CFR)	
49 CFR 192	Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards
FEDERAL SPECIFICATIONS (FS)	
FS L-C-530	(Rev C) Coating, Pipe, Thermoplastic Resin
MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)	
MSS SP-25	(1993) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-84	(1990) Valves - Socket Welding and Threaded Ends
NATIONAL ASSOCIATION OF CORROSION ENGINEERS (NACE)	
NACE RP-02	(1974) High Voltage Electrical Inspection of Pipeline Coatings Prior to Installation
STEEL STRUCTURES PAINTING COUNCIL (SSPC)	
SSPC SP 6	(1991) Commercial Blast Cleaning
UNDERWRITERS LABORATORIES (UL)	
UL-06	(1994) Gas and Oil Equipment Directory

## **1.2 GENERAL REQUIREMENTS**

### **1.2.1 Scope of Work**

Work by this specification includes any and all underground piping required to serve the new mechanical equipment.

### **1.2.2 Jointing Polyethylene and Fiberglass Piping**

Piping shall be joined by performance qualified joiners using qualified procedures in accordance with AGA-01. Manufacturer's prequalified joining procedures shall be used. Joints shall be inspected by an inspector qualified in the joining procedures being used and in accordance with AGA-01. Joiners and inspectors shall be qualified at the jobsite by a person who has been trained and certified by the manufacturer of the pipe, to train and qualify joiners and inspectors in each joining procedure to be used on the job. Training shall include use of equipment, explanation of the procedure, and successfully making joints which pass tests specified in AGA-01. The Contracting Officer shall be notified at least 24 hours in advance of the date to qualify joiners and inspectors.

### **1.2.3 Standard Products**

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Asbestos or products containing asbestos shall not be used. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site. Valves, flanges, and fittings shall be marked in accordance with MSS SP-25.

### **1.2.4 Verification of Dimensions**

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

### **1.2.5 Handling**

Pipe and components shall be handled carefully to ensure a sound, undamaged condition. Particular care shall be taken not to damage pipe coating. No pipe or material of any kind shall be placed inside another pipe or fitting after the coating has been applied, except as specified in paragraph INSTALLATION. Plastic pipe shall be handled in conformance with AGA-01.

## **PART 2 PRODUCTS**

### **2.1 PIPE, FITTINGS, AND ASSOCIATED MATERIALS**

#### **2.1.1 Steel Pipe**

Steel pipe shall conform to ASTM A 53, Grade A or B, Type E or S, Schedule 40; or API Spec 5L seamless or electric resistance welded, Schedule 40, black steel pipe as specified in ASME B31.8. Furnace butt welded pipe may be used in sizes 1-1/2 inches and smaller. Steel pipe limited to above grade installation.

#### **2.1.2 Small Fittings**

Fittings 1-1/2 inches and smaller shall conform to ASME B16.11.

#### **2.1.3 Fittings, 2 Inches and Larger**

Pipe flanges and flanged fittings including bolts, nuts, and bolt patterns shall be in accordance with ASME B16.5, Class 125. Buttweld fittings shall be in accordance with ASME B16.9. Weld neck flanges shall be used.

#### **2.1.4 Steel Forged Branch Connections**

Connections shall conform to ASTM A 181, Class 60, carbon steel.

#### **2.1.5 Flange Gaskets**

Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1/16 inch minimum thickness, full face or self-centering flat ring type. The gaskets shall contain aramid fibers bonded with nitrile butadiene rubber (NBR), or glass fibers bonded with polytetrafluorethylene, suitable for maximum 600 degrees F service and meeting applicable requirements of ASME B31.8.

#### **2.1.6 Pipe Threads**

Pipe threads shall conform to ASME B1.20.1.

#### **2.1.7 Polyethylene Pipe, Tubing, Fittings and Joints**

Polyethylene pipe, tubing, fittings and joints shall conform to ASTM D 3350 and ASTM D 2513, pipe designations PE 2406 and PE 3408, rated SDR 21 or less, as specified in ASME B31.8. Pipe sections shall be marked as required by ASTM D 2513. Butt fittings shall conform to ASTM D 3261 and socket fittings shall conform to ASTM D 2683. Fittings shall match the service rating of the pipe.

#### **2.1.8 Sealants for Steel Pipe Threaded Joints**

##### **2.1.8.1 Sealing Compound**

Joint sealing compound shall be as listed in UL-06, Class 20 or less.

##### **2.1.8.2 Tape**

Polytetrafluoroethylene tape shall conform to ASTM D 3308.

##### **2.1.9 Identification**

Pipe flow markings and metal tags for each valve, meter, and regulator shall be provided as required by the Contracting Officer.

##### **2.1.10 Insulating Joint Materials**

Insulating joint materials shall be provided between flanged or threaded metallic pipe systems where shown to isolate galvanic or electrolytic action.

###### **2.1.10.1 Threaded Joints**

Joints for threaded pipe shall be steel body nut type dielectric type unions with insulating gaskets.

###### **2.1.10.2 Flanged Joints**

Joints for flanged pipe shall consist of full face sandwich-type flange insulating gasket of the dielectric type, insulating sleeves for flange bolts and insulating washers for flange nuts.

##### **2.1.11 Gas Transition Fittings**

Gas transition fittings shall be manufactured steel fittings approved for jointing steel and polyethylene or fiberglass pipe. Approved transition fittings are those that conform to AGA-01 requirements for transition fittings.

#### **2.2 VALVES**

Valves shall be suitable for shutoff or isolation service and shall conform to the following:

##### **2.2.1 Steel Valves**

Steel valves 1-1/2 inches and smaller installed underground shall conform to MSS SP-84, carbon steel, socket weld ends, with square wrench operator adaptor. Steel valves 1-1/2 inches and smaller installed aboveground shall

conform to MSS SP-84, carbon steel, socket weld or threaded ends with handwheel or wrench operator. Steel valves 2 inches and larger installed underground shall conform to-API Spec 6D, carbon steel, butt-welded ends, Class 125 with square wrench operator adaptor. Steel valves 2 inches and larger installed aboveground shall conform to API Spec 6D, carbon steel, butt-welded or flanged ends, Class 125 with handwheel or wrench operator.

## **2.3 PRESSURE REGULATORS**

Regulators shall have ferrous bodies, shall provide backflow and vacuum protection, and shall be designed to meet the pressure, load and other service conditions.

### **2.3.1 Gas Main Regulators**

Pressure regulators for main distribution lines, supplied from a source of gas which is at a higher pressure than the maximum allowable operating pressure for the system, and shall be equipped with pressure regulating devices of adequate capacity. In addition to the pressure regulating devices, a suitable method shall be provided to prevent overpressuring of the system in accordance with ASME B31.8. Suitable protective devices are as follows:

- a. Spring-loaded relief valve meeting the provisions of ASME BPV VIII Div 1.
- b. Pilot-loaded back pressure regulator used as relief valve, so designed that failure of the pilot system will cause the regulator to open.
- c. Weight-loaded relief valves.
- d. Monitoring regulator installed in series with the primary pressure regulator.
- e. Series regulator installed upstream from the primary regulator, set to limit the pressure on the inlet of the primary regulator continuously to the maximum allowable operating pressure of the system, or less.
- f. Automatic shutoff device installed in series with the primary regulator, set to shut off when the pressure on the distribution system reaches the maximum allowable operating pressure of the system, or less. This device shall remain closed until manually reset.
- g. Spring-loaded, diaphragm type relief valves.

### **2.3.2 Service Line Regulators**

Pressure regulators for individual service lines shall have ferrous bodies. Regulator shall be capable of reducing distribution line pressure to pressures required for users. Regulators shall be provided where gas will be distributed at pressures in excess of 10 inches of water column. Pressure relief shall be set at a lower pressure than would cause unsafe operation of any connected user. Regulators for liquefied petroleum gas shall be adjusted to 10 to 12 inches of water column. Pressure relief for liquefied petroleum gas shall be set at 16 inches of water column. Regulator shall have single port with orifice diameter no greater than that recommended by the manufacturer for the maximum gas pressure at the regulator inlet. Regulator valve vent shall be of resilient materials designed to withstand flow conditions when pressed against the valve port. Regulator shall be capable of

regulating downstream pressure within limits of accuracy and shall be capable of limiting the buildup of pressure under no-flow conditions to 50 percent or less of the discharge pressure maintained under flow conditions. Regulator shall have a self contained service regulator. Regulator pipe connections shall not exceed 2 inch size.

## **2.4 PROTECTIVE COVERING MATERIALS**

### **2.4.1 Thermoplastic Resin Coating System**

Continuously extruded polyethylene and adhesive coating system materials shall conform to FS L-C-530, Part (3).

## **PART 3 EXECUTION**

### **3.1 EXCAVATION AND BACKFILLING**

Earthwork shall be as specified in Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

### **3.2 GAS MAINS**

Pipe for gas mains shall be polyethylene. Polyethylene mains shall not be aboveground.

### **3.3 SERVICE LINES**

Service lines shall be constructed of materials specified for gas mains and shall extend from a gas main to and including the point of delivery within 5 feet of the building. The point of delivery is the service regulator or shutoff valve. The service lines shall be connected to the gas mains through service tees, with end of run plugged. The service lines shall be as short and as straight as practicable between the point of delivery and the gas main and shall not be bent or curved laterally unless necessary to avoid obstructions or otherwise permitted. Service lines shall be laid with as few joints as practicable using standard lengths of pipe. Shorter lengths shall be used only for closures. Polyethylene or fiberglass service lines shall not be installed aboveground except as permitted in ASME B31.8.

### **3.4 WORKMANSHIP AND DEFECTS**

Pipe, tubing, and fittings shall be clear and free of cutting burrs and defects in structure or threading and shall be thoroughly brushed and blown free of chips and scale. Defective pipe, tubing, or fittings shall be replaced and shall not be repaired.

### **3.5 PROTECTIVE COVERING**

#### **3.5.1 Protective Covering for Underground Steel Pipe**

Except as otherwise specified, protective coverings shall be applied mechanically in a factory or field plant especially equipped for the purpose. Valves and fittings that cannot be coated and wrapped mechanically shall have the protective covering applied by hand, preferably at the plant that applies the covering to the pipe. Joints shall be coated and wrapped by hand. Hand coating and wrapping shall be done in a manner and with materials that will produce a covering equal in thickness to that of the covering applied mechanically.



#### **3.5.1.1 Thermoplastic Resin Coating System**

The coating system shall conform to FS L-C-530, Part (3). The exterior of the pipe shall be cleaned to a commercial grade blast cleaning finish in accordance with SSPC SP 6. Adhesive compound shall be applied to the pipe. Immediately after the adhesive is applied, a seamless tube of polyethylene shall be extruded over the adhesive to produce a bonded seamless coating. The nominal thickness of the pipe coating system shall be 10 mils (plus or minus 10 percent) of adhesive and 40 mils (plus or minus 10 percent) of polyethylene for pipes up to 16 inches in diameter. For pipes 18 inches and larger in diameter, the pipe coating system thickness shall be 10 mils (plus or minus 10 percent) adhesive and 60 mils (plus or minus 10 percent) polyethylene. Joint coating and field repair material shall be applied as recommended by the coating manufacturer and shall be one of the following:

- a. Heat shrinkable polyethylene sleeves.
- b. Polyvinyl chloride pressure-sensitive adhesive tape.
- c. High density polyethylene/bituminous rubber compound tape.

The coating system shall be inspected for holes, voids, cracks, and other damage during installation.

#### **3.5.1.2 Inspection of Pipe Coatings**

Any damage to the protective covering during transit and handling shall be repaired before installation. After field coating and wrapping has been applied, the entire pipe shall be inspected by an electric holiday detector with impressed current set at a value in accordance with NACE RP-02 using a full-ring, spring-type coil electrode. The holiday detector shall be equipped with a bell, buzzer, or other type of audible signal which sounds when a holiday is detected. All holidays in the protective covering shall be repaired immediately upon detection. The Contracting Officer reserves the right to inspect and determine the suitability of the detector. Labor, materials, and equipment necessary for conducting the inspection shall be furnished by the Contractor.

#### **3.5.2 Protective Covering for Aboveground Piping Systems**

Finish painting shall conform to the applicable paragraphs of Section 09900 PAINTING, GENERAL and as follows:

##### **3.5.2.1 Ferrous Surfaces**

Shop primed surfaces shall be touched up with ferrous metal primer. Surfaces that have not been shop primed shall be solvent-cleaned. Surfaces that contain loose rust, loose mill scale, and other foreign substances shall be mechanically cleaned by power wire brushing or commercial sandblasted and primed with ferrous metal primer or vinyl type wash coat. Primed surface shall be finished with two coats of exterior oil paint or vinyl paint.

##### **3.5.2.2 Nonferrous Surfaces**

Nonferrous surfaces shall not be painted.

#### **3.5.3 Protective Covering for Piping in Valve Boxes and Manholes**

Piping in valve boxes or manholes shall receive protective coating as specified for underground steel pipe.

### **3.6 INSTALLATION**

Gas distribution system and equipment shall be installed in conformance with the manufacturer's recommendations and applicable sections of ASME B31.8, AGA-01 and 49 CFR 192. Abandoning existing gas piping shall be done in accordance with ASME B31.8. Pipe shall be cut without damaging the pipe. Unless otherwise authorized, cutting shall be done by an approved type of mechanical cutter. Wheel cutters shall be used where practicable. On steel pipe 6 inches and larger, an approved gas-cutting-and-beveling machine may be used. Cutting of plastic pipe shall be in accordance with AGA-01. Valve installation in plastic pipe shall be designed to protect the plastic pipe against excessive torsional or shearing loads when the valve is operated and from other stresses which may be exerted through the valve or valve box.

#### **3.6.1 Installing Pipe Underground**

Gas mains and service lines shall be graded as indicated. Joints in steel pipe shall be welded except as otherwise permitted for installation of valves. Mains shall have 24 inch minimum cover; service lines shall have 18 inch minimum cover; and both mains and service lines shall be placed on firmly compacted select material for the full length. Where indicated, the main shall be encased, bridged, or designed to withstand any anticipated external loads as specified in ASME B31.8. The encasement material shall be standard weight black steel pipe with a protective coating as specified. The pipe shall be separated from the casing by insulating spacers and sealed at the ends with casing bushings. Trench shall be excavated below pipe grade, bedded with bank sand, and compacted to provide full-length bearing. Laying the pipe on blocks to produce uniform grade will not be permitted. The pipe shall be clean inside before it is lowered into the trench and shall be kept free of water, soil, and all other foreign matter that might damage or obstruct the operation of the valves, regulators, meters, or other equipment. When work is not in progress, open ends of pipe or fittings shall be securely closed by expandable plugs or other suitable means. Minor changes in line or gradient of pipe that can be accomplished through the natural flexibility of the pipe material without producing permanent deformation and without overstressing joints may be made when approved. Changes in line or gradient that exceed the limitations specified shall be made with fittings. When cathodic protection is furnished, electrically insulated joints or flanges shall be provided. When polyethylene or fiberglass piping is installed underground, foil backed magnetic tape shall be placed above the pipe to permit locating with a magnetic detector. After laying of pipe and testing, trench shall be backfilled in accordance with Section 02222 EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITY SYSTEMS.

#### **3.6.2 Installing Pipe Aboveground**

Aboveground piping shall be protected against dirt and other foreign matter as specified for underground piping. Joints in steel pipe shall be welded; however joints in pipe 1-1/2 inches in diameter and smaller may be threaded; joints may also be threaded to accommodate the installation of valves. Flanges shall be of the weld neck type to match wall thickness of pipe.

### **3.7 PIPE JOINTS**

Pipe joints shall be designed and installed to effectively sustain the longitudinal pullout forces caused by the contraction of piping or superimposed loads.

### **3.7.1 Threaded Steel Joints**

Threaded joints in steel pipe shall have tapered threads evenly cut and shall be made with UL approved graphite joint sealing compound for gas service or polytetrafluoroethylene tape applied to the male threads only. Caulking of threaded joints to stop or prevent leaks will not be permitted.

### **3.7.2 Welded Steel Joints**

Gas pipe weldments shall be as indicated. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either welding tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.8. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected adversely. Electrodes that have been wetted or have lost any of their coating shall not be used.

### **3.7.3 Polyethylene Pipe Jointing Procedures**

Jointing procedures shall conform to AGA-01. Indiscriminate heat fusion joining of plastic pipe or fittings made from different polyethylene resins by classification or by manufacturer shall be avoided if other alternative jointing procedures are available. If heat fusion joining of dissimilar polyethylenes is required, special procedures are required. The method of heat fusion joining dissimilar polyethylene resins shall be tested in accordance with paragraph TESTS, subparagraph Destructive Tests of Plastic Pipe Joints.

### **3.7.4 Connections Between Metallic and Plastic Piping**

Connections shall be made only outside, underground, and with approved transition fittings.

## **3.8 VALVE BOXES**

Valve boxes of cast iron not less than 3/16 inch thick shall be installed at each underground valve except where concrete or other type of housing is indicated. Valve boxes shall be provided with locking covers that require a special wrench for removal. Wrench shall be furnished for each box. The word "gas" shall be cast in the box cover. When the valve is located in a roadway, the valve box shall be protected by a suitable concrete slab at least 3 square feet. When in a sidewalk, the top of the box shall be in a concrete slab 2 feet square and set flush with the sidewalk. Boxes shall be adjustable extension type with screw or slide-type adjustments. Valve boxes shall be separately supported, not resting on the pipe, so that no traffic loads can be transmitted to the pipe. Valves shall only be located in valve boxes or inside of buildings.

## **3.9 DRIPS**

Drips shall be installed at locations where required. Drips may be commercial units of required type and capacity. A blow off pipe 1-1/4 inches or larger

shall be connected to each drip at its lowest point and shall extend to or near the ground surface at a convenient location away from traffic. Discharge for each drip terminal (outlet) shall be provided with a reducing fitting, a plug valve, and a 1/2 inch nipple turned down. .

### **3.10 PRESSURE REGULATOR INSTALLATION**

#### **3.10.1 Main Distribution Line Regulators**

Pressure regulators shall be installed where required inside equipment rooms. A valve shall be installed on each side of the regulator for isolating the regulator for maintenance.

#### **3.10.2 Service Line Regulators**

A shutoff valve, meter set assembly, and service regulator shall be installed on the service line outside the building, 450 mm (18 inches) above the ground on the riser. An insulating joint shall be installed on the inlet side of the meter set assembly and service regulator and shall be constructed to prevent flow of electrical current. A 3/8 inch tapped fitting equipped with a plug shall be provided on both sides of the service regulator for installation of pressure gauges for adjusting the regulator. All service regulator vents and relief vents shall terminate in the outside air in rain and insect resistant fittings. The open end of the vent shall be located where gas can escape freely into the atmosphere, away from any openings into the building and above areas subject to flooding.

### **3.11 CONNECTIONS TO EXISTING LINES**

Connections between new work and existing gas lines, where required, shall be made in accordance with ASME B31.8 using proper fittings to suit the actual conditions. When connections are made by tapping into a gas main, the connecting fittings shall be the same size as the pipe being connected.

#### **3.11.1 Connection to Government Owned/Operated Gas Lines**

The Contractor shall provide connections to the existing gas lines in accordance with approved procedures. Reactivation of any existing gas lines will only be done by the Government. The Contractor's Connection and Abandonment Plan shall be submitted and approved prior to making any connections to existing gas lines. The Contractor shall notify the Contracting Officer, in writing, 10 days before connections to existing lines are to be made.

a. If facilities are abandoned in place, they shall be physically disconnected from the piping system. The open ends of all abandoned facilities shall be purged, capped, plugged or otherwise effectively sealed. Abandonment shall not be completed until it has been determined that the volume of gas or liquid hydrocarbons contained within the abandoned section poses no potential hazard. Air or inert gas may be used for purging, or the facility may be filled with water or other inert material. If air is used for purging, the Contractor shall ensure that a combustible mixture is not present after purging.

b. When a main is abandoned, together with the service lines connected to it, only the customer's end of such service lines is required to be sealed as stipulated above.

c. Service lines abandoned from the active mains shall be disconnected as close to the main as practicable.

- d. All valves left in the abandoned segment shall be closed.
- e. All abovegrade valves, risers, and vault and valve box covers shall be removed. Vault and valve box voids shall be filled with suitable compacted backfill material.

### **3.12 TESTS**

#### **3.12.1 Destructive Tests of Plastic Pipe Joints**

Each day, prior to making polyethylene heat fusion joints or fiberglass adhesive joints, a joint of each size and type to be installed that day shall be made by each person performing joining of plastic pipe that day and destructively tested. At least 3 longitudinal straps shall be cut from each joint. Each strap shall be visually examined, shall not contain voids or discontinuities on the cut surfaces of the joint area, and shall be deformed by bending, torque, or impact, and if failure occurs, it must not initiate in the joint area. If a joint fails the visual or deformation test, the qualified joiner who made that joint shall not make further field joints in plastic pipe on this job until that person has been retrained and requalified. The results of the destructive tests shall be recorded to include the date and time of the tests, size and type of the joints, ambient conditions, fusion iron temperature and names of inspectors and joiners.

#### **3.12.2 Pressure and Leak Tests**

The system of gas mains and service lines shall be tested after construction and before being placed in service using air as the test medium. The normal operating pressure for the system shall be verified by the Contractor. Prior to testing the system, the interior shall be blown out, cleaned and cleared of all foreign materials. All meters, regulators, and controls shall be removed before blowing out and cleaning and reinstalled after clearing of all foreign materials. Testing of gas mains and service lines shall be done with due regard for the safety of employees and the public during the test. Persons not working on the test operations shall be kept out of the testing area while testing is proceeding. The test shall be made on the system as a whole or on sections that can be isolated. Joints in sections shall be tested prior to backfilling when trenches must be backfilled before the completion of other pipeline sections. The test shall continue for at least 24 hours from the time of the initial readings to the final readings of pressure and temperature. The initial test readings of the instrument shall not be made for at least 1 hour after the pipe has been subjected to the full test pressure, and neither the initial nor final readings shall be made at times of rapid changes in atmospheric conditions. The temperatures shall be representative of the actual trench conditions. There shall be no indication of reduction of pressure during the test after corrections have been made for changes in atmospheric conditions in conformity with the relationship  $T(1)P(2)=T(2)P(1)$ , in which T and P denote absolute temperature and pressure, respectively, and the numbers denote initial and final readings. During the test, the entire system shall be completely isolated from all compressors and other sources of air pressure. Each joint shall be tested by means of soap and water or an equivalent nonflammable solution prior to backfilling or concealing any work. The testing instruments shall be approved by the Contracting Officer. All labor, materials and equipment for conducting the tests shall be furnished by the Contractor and shall be subject to inspection at all times during the tests. The Contractor shall maintain safety precautions for air pressure testing at all times during the tests.

--End of Section--

## **SECTION 02811**

### **UNDERGROUND SPRINKLER SYSTEMS**

#### **PART I. GENERAL**

##### **1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

##### **AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

ASTM D 1785 (1991) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

ASTM D 2464 (1991) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

##### **AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)**

ASSE 1020 (1989) Pressure Vacuum Breaker Assembly (Recommended for Outdoor Usage)

##### **NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)**

NFPA 70 (1993) National Electrical Code

##### **1.2 PERFORMANCE REQUIREMENTS**

System shall operate with a minimum water pressure of 35 psi at connection to meter at the last head in each zone.

##### **1.3 DELIVERY AND STORAGE**

All equipment delivered and placed in storage shall be protected from the weather; excessive humidity and temperature variation; direct sunlight (in the case of plastic or rubber materials); and dirt, dust, or other contaminants.

##### **1.4 FIELD MEASUREMENTS**

The Contractor shall verify all dimensions in the field and shall advise the Contracting Officer's representative of any discrepancy before performing the work.

#### **PART 2 PRODUCTS**

##### **2.1 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS**

###### **2.1.1 Standard Products**

Materials and equipment shall be the standard products of a manufacturer who has produced similar systems which have performed well for a minimum period of 2 years prior to bid opening. Equipment shall be supported by a service

organization that is, in the opinion of the Contracting Officer's representative, reasonably convenient to the site.

#### **2.1.2 Nameplates**

Each item of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

#### **2.1.3 Extra Stock**

The following extra stock shall be provided: Two sprinkler heads of each size and type, two valve keys for operating manual valves, two wrenches for removing and installing each type of head, two quick coupler keys and hose swivels, and four irrigation controller housing keys.

### **2.2 PIPING MATERIALS**

#### **2.2.1 Polyvinyl Chloride (PVC) Pipe, Fittings and Solvent Cement**

##### **2.2.1.1 Pipe**

Pipe shall conform to the requirements of ASTM D 1785, PVC 1120 Schedule 40 or ASTM D 2241, PVC 1120 SDR 21, Class 160.

##### **2.2.1.2 Fittings**

Solvent welded socket type fittings shall conform to requirements of ASTM D 2466, Schedule 40. Threaded type fittings shall conform to requirements of ASTM D 2464, Schedule 80.

##### **2.2.1.3 Solvent Cement**

Solvent cement shall conform to the requirements of ASTM D 2564.

### **2.3 SPRINKLER AND EMITTER HEADS**

#### **2.3.1 Pop-Up Spray Heads**

Pop-up spray heads lay flush with housing, then pop up when water pressure is activated in system. The rising member supporting the nozzle shall be identical on full, half, third or quarter pattern sprinklers so that nozzles will be interchangeable. The sprinkler head shall be designed to be adjustable for coverage and flow. The nozzle shall be removable so head does not have to be removed for flushing or cleaning. Nozzle rises a minimum of 12 inches above the body. The body shall be constructed with a 1/2 inch female thread for installation in a fixed underground pipe system.

##### **2.3.1.1 Shrubbery Sprinkler Heads**

Sprinkler heads shall be conical spray with adjustable or non-adjustable coverage and designed for permanent aboveground mounting on riser or pop-ups at a height compatible with ground covers. Provide brass nozzles.

##### **2.3.2 Rotary Pop-Up Sprinklers**

Sprinklers shall be capable of covering 40 feet diameter at 45 psi. Construction shall be high impact molded plastic with filter screen, reducible watering radius, and choice of specified nozzles and have adjustable radius capabilities.

### **2.3.3 Sprinkler Heads**

Heads shall be multiple-spray bubbler with adjustable flow and designed for

### **2.3.4 Remote Control Valves, Electrical**

Remote control valves shall be solenoid actuated globe valves of 1 to 2 inch size, suitable for 24 volts, 60 50 cycle, and designed to provide for shut-off in event of power failure. Valve shall be brass or plastic housing suitable for service at 150 psi operating pressure with external flow control adjustment for shut-off capability, external plug at diaphragm chamber to enable manual operation, filter in control chamber to prevent valve body clogging with debris, durable diaphragm, and accessibility to internal parts without removing valve from system.

#### **2.3.4.1 Automatic Valves**

Automatic valves shall be plastic, spring loaded ball drip type, Class 150 pounds and threaded ends, designed to close at 6 foot pressure head with positive seal at 3 psi pressure or greater and be open to drain at less than 3 psi pressure.

### **2.3.5 Pressure Regulating Master Valve**

### **2.3.6 Backflow Preventers**

Reduced pressure principle assemblies, double check valve assemblies, atmospheric (nonpressure) type vacuum breakers, and pressure type vacuum breakers shall be tested, approved, and listed in accordance with FCCHR-01. Backflow preventers with intermediate atmospheric vent shall be in accordance with ASSE 1012. Reduced pressure principle backflow preventers shall be in accordance with ASSE 1013.

#### **2.3.6.1 Pressure Type Vacuum Breaker**

Vacuum breaker shall conform to the requirements of ASSE 1020 and shall be bronze or brass construction, with one or two check valves, vacuum relief, inlet and discharge shut-offs valves, field test cocks, and vacuum relief opening of greater diameter than unit.

#### **2.3.6.2 Valve Boxes**

Valve boxes shall be plastic lockable, for each gate valve, manual control valve and remote control valve. Box sizes shall be adjustable for valve used. Word "IRRIGATION" shall be cast on cover. Shaft diameter of box shall be minimum 5-1/4 inches. Cast iron box shall have bituminous coating.

#### **2.3.6.3 Riser Adapters**

Riser adapters shall be provided with a rigid piping system.

## **2.4 AUTOMATIC CONTROLLERS, ELECTRICAL**

Controller shall conform to the requirements of NEMA ICS 2 with 120-volt single phase service, operating with indicated stations, and grounded chassis. Enclosure shall conform to NEMA ICS 6 Type 3R, with locking hinged cover, wall-mounted. Controller shall be programmed for various schedules by setting switches and dials equipped with the following features: A switch for each day of week for two schedules, allowing each station to be scheduled



individually as to days of watering; a minute switch for each station with a positive increment range of 3 to 60 minutes, set time within one percent; a switch allowing selected schedules to be repeated after each completion of initial watering schedule and allowing each operation to be scheduled throughout a 24-hour day; a circuit breaker for surge protection; and circuit for a 9-volt rechargeable NiCad battery.

## **2.5 ELECTRICAL WORK**

Wiring and rigid conduit for electrical power shall be in accordance with NFPA 70, and Section 16375, ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

## **2.6 WATER SUPPLY MAIN MATERIALS**

Tapping sleeves, service cut off valves, and connections to water supply mains shall be in accordance with Section 02660, WATER LINES.

## **2.7 INSULATING JOINTS**

Insulating joints and dielectric fittings shall be in accordance with Section 02660, WATER LINES.

# **PART 3 EXECUTION**

## **3.1 INSTALLATION**

Sprinkler system shall be installed after site grading has been completed. Excavation, trenching, and backfilling for sprinkler system shall be in accordance with the applicable provisions of Section 02222, EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, except as modified herein.

### **3.1.1 Trenching**

Trench around roots shall be hand excavated to pipe grade when roots of 2 inches diameter or greater are encountered. Trench width shall be 12 inches minimum. Backfill shall be hand tamped over excavation. Trenches shall be kept free of obstructions and debris that would damage pipe. Subsoil shall not be mixed with topsoil. Existing concrete walks, drives and other obstacles shall be bored at a depth conforming to bottom of adjacent trenches. Pipe sleeves for bored pipe shall be two pipe diameters larger than sprinkler pipe.

### **3.1.2 Piping System**

#### **3.1.2.1 Cover**

Underground piping shall be installed as to meet the minimum depth of backfill cover specified.

### **3.1.3 Piping Installation**

#### **3.1.3.1 Polyvinyl Chloride (PVC) Pipe**

a. Solvent-cemented joints shall conform to the requirements of ASTM D 2855.

b. Threaded joints shall be full cut with a maximum of three threads remaining exposed on pipe and nipples. Threaded joints shall be made tight without recourse to wicks or fillers, other than polytetrafluoroethylene thread tape.

#### **3.1.3.2 Emitter Hose**

Emitter laterals shall be buried 6 inches deep. Connections shall be solvent welded in accordance with manufacturer's recommendation to standard weight Schedule 40 PVC fittings and bushings. Hose shall be installed in a serpentine manner. When cutting hose, shearing tool such as a pipe cutter, knife, or shears shall be used. Manufacturer's recommended tool and procedures when punching hose for emitters shall be followed.

#### **3.1.4 Control Wire and Conduit**

##### **3.1.4.1 Wires**

Low voltage wires may be buried beside pipe in same trench. Rigid conduit shall be provided where wires run under paving. Wires shall be number tagged at key locations along main to facilitate service. One control circuit shall be provided for each zone and a circuit to control sprinkler system.

##### **3.1.4.2 Loops**

A 12 inch loop of wire shall be provided at each valve where controls are connected.

##### **3.1.4.3 Expansion and Contraction**

Multiple tubes or wires shall be bundled and taped together at 20 foot intervals with 12 inch loop for expansion and contraction.

##### **3.1.4.4 Splices**

Electrical splices shall be waterproof.

#### **3.1.5 Automatic Controller**

Exact field location of controllers shall be determined before installation. Coordinate the electrical service to these locations. Install in accordance with manufacturer's recommendations and NFPA 70.

#### **3.1.6 Backfill**

##### **3.1.6.1 Minimum Cover**

Depth of cover shall be 12 inches. Remainder of trench or pipe cover shall be filled to within 3 inches of top with excavated soil, and compact soil with plate hand-held compactors to same density as undisturbed adjacent soil.

##### **3.1.6.2 Restoration**

Top 3 inches shall be filled with topsoil and compacted with same density as surrounding soil. Lawns and plants shall be restored in accordance with Section 02935, TURF, and Section 02950, TREES, SHRUBS, GROUND COVERS AND VINES.

#### **3.1.7 Adjustment**

After grading, seeding, and rolling of planted areas, sprinkler heads shall be adjusted flush with finished grade. Adjustments shall be made by providing new nipples of proper length or by use of heads having an approved device, integral with head, which will permit adjustment in height of head without changing piping.

### **3.1.8 Cleaning of Piping**

Prior to the hydrostatic and operation tests, the interior of the pipe shall be flushed with clean water until pipe is free of all foreign materials. Flushing and cleaning out of system pipe, valves, and components shall not be considered completed until witnessed and accepted by Contracting Officer's representative.

## **3.2 FIELD TESTS**

All instruments, equipment, facilities, and labor required to conduct the tests shall be provided by Contractor.

### **3.2.1 Hydrostatic Pressure Test**

Piping shall be tested hydrostatically before backfilling and proved tight at a hydrostatic pressure of 150 psi without pumping for a period of one hour with an allowable pressure drop of 5 psi. If hydrostatic pressure cannot be held for a minimum of 4 hours, Contractor shall make adjustments or replacements and the tests repeated until satisfactory results are achieved and accepted by the Contracting Officer's representative.

### **3.2.2 Leakage Tests**

Leakage tests for service main shall be in accordance with Section 02660, WATER LINES.

### **3.2.3 Operation Test**

At conclusion of pressure test, sprinkler heads or emitter heads, quick coupling assemblies, and hose valves shall be installed and entire system tested for operation under normal operating pressure. Operation test consists of the system operating through at least one complete programmed cycle for all areas to be sprinkled.

## **3.3 POSTING FRAMED INSTRUCTIONS**

Framed instructions containing wiring and control diagrams under glass or in laminated plastic shall be posted where directed. Condensed operating instructions, prepared in typed form, shall be framed as specified above and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the system. After as-built drawings are approved by Contracting Officer's representative, controller charts and programming schedule shall be prepared. One chart for each controller shall be supplied. Chart shall be a reduced drawing of actual as-built system that will fit the maximum dimensions inside controller housing. Black line print for chart and a different pastel or transparent color shall indicate each station area of coverage. After chart is completed and approved for final acceptance, chart shall be sealed between two 20 mil pieces of clear plastic.

## **3.4 CLEANUP**

Upon completion of installation of system, all debris and surplus materials resulting from the work shall be removed.

--End of Section--

## SECTION 02935

### TURF

#### **PART 1 GENERAL**

##### **1.1 SUMMARY (Not Applicable)**

##### **1.2 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

###### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2607 (1969) Peats, Mosses, Humus, and Related Products

###### AMERICAN SOD PRODUCERS ASSOCIATION, INC. (ASPA)

ASPA-01 (Undated) Guideline Specifications to Sodding

###### FEDERAL SPECIFICATION (FS)

FS O-F-241 (Rev. D) Fertilizers, Mixed, Commercial

##### **1.3 INCREMENTAL PLANTING**

In order to minimize soil erosion due to exposure of graded areas to water runoff, the Contractor shall plant grass in either linear or area increments. The Contractor shall complete all tillage, sodding, and mulching work immediately after final grading has been completed on each 1,000 linear feet of roads, levees, dikes, ditches and channels, and on each 5 acre increment of lock mounds, excess material mounds, or other large expanses of areas to be grassed.

##### **1.4 SOURCE INSPECTIONS**

Sod material will be subject to inspection by the Contracting Officer's representative at the growing site.

##### **1.5 DELIVERY, STORAGE, AND HANDLING**

###### **1.5.1 Delivery**

###### **1.5.1.1 Inspection**

Turf material shall be inspected upon arrival at the jobsite, and unacceptable material shall be removed from the jobsite.

###### **1.5.1.2 Protection**

Sod shall be protected from drying out and from contamination during delivery.

### **1.5.1.3 Fertilizer and Lime**

Delivery of fertilizer and lime to the site shall be in original, unopened containers bearing manufacturer's chemical analysis. Instead of containers, fertilizer and lime may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

### **1.5.2 Storage**

Materials shall be stored in areas approved by the Contracting Officer's representative.

Sod shall be lightly sprinkled with water, covered with moist burlap, straw, or other covering; and protected from exposure to wind and direct sunlight until planted. Covering for sod shall allow air to circulate and prevent internal heat from building up.

### **1.5.3 Handling**

#### **1.5.3.1 Materials**

Except for bulk deliveries, materials shall not be dropped or dumped from vehicles.

#### **1.5.3.2 Time Limitation for Sod**

Limitation of the time between harvesting and placing of sod shall be as specified in paragraph "SODDING".

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

#### **2.1.1 Sod**

##### **2.1.1.1 Sod Classification**

State-certified sod shall be provided as classified in the ASPA-01. Sod shall be machine cut to a uniform thickness of 1-1/4 inches within a tolerance of 1/4 inch, excluding top growth and thatch. The sod shall be free of diseases, nematodes, and soil-borne insects, undesirable plants, stones larger than 2-inches in any dimension, woody plant roots and other material detrimental to the development of the turf.

##### **2.1.1.2 Grass Species**

Sod shall be Argentine Bahia.

##### **2.1.1.3 Broken Sections**

Irregularly shaped pieces of sod and torn or uneven ends will be rejected.

#### **2.1.2 Topsoil**

Topsoil shall be the existing surface soil which has been stripped and stockpiled on the site.

Additional topsoil, if required beyond that available from stripping operations, shall be a natural, friable soil representative of productive

soils in the vicinity. It shall be obtained from well-drained borrow areas provided by the Contractor and shall be free of any admixture of subsoil, foreign matter, objects larger than one inch in any dimension, toxic substances, and any material or substance that may be harmful to plant growth. The pH range shall be 5.3 to 6.0. Topsoil that does not meet the lower pH limit shall be amended by the addition of lime, at a rate recommended based on soil tests.

### **2.1.3 Soil Amendments**

Soil amendments shall consist of lime and fertilizer meeting the following requirements.

#### **2.1.3.1 Lime**

The Contractor shall use either agricultural limestone or marl.

a. Agricultural limestone shall have a minimum calcium carbonate equivalent of 90 percent and shall be ground to such a fineness that at least 90 percent will pass a 10-mesh sieve and at least 50 percent will pass a 60 mesh sieve.

#### **2.1.3.2 Fertilizer**

Fertilizer shall be commercial grade, free flowing, uniform in composition and conforming to FS O-F-241, Type I, Class 2 and shall bear the manufacturer's guaranteed statement of analysis.

a. Granular Fertilizer: Shall consist of a nitrogen-phosphorus-potassium fertilizer analysis having all of the nitrogen in the nitrate or ammoniacal form and shall be selected from one of the following grades: 13-13-13.

#### **2.1.4 Mulch**

Mulch shall be free from weeds, mold, and other deleterious materials.

##### **2.1.4.1 Straw**

Straw shall be stalks from oats, wheat, rye, peanut, barley, or rice. Straw shall be furnished in air-dry condition having a consistency for placing with commercial mulch blowing equipment.

##### **2.1.4.2 Hay**

Hay shall be native hay, or other herbaceous mowings. Hay shall be furnished in an air-dry condition having a consistency for placing with commercial mulch blowing equipment.

##### **2.1.4.3 Wood Cellulose Fiber**

Wood cellulose fiber shall not contain any growth or germination-inhibiting factors and shall be dyed an appropriate color to facilitate visual metering during application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 3.5 to 5.0. Use with hydroseeding application of grass seed and fertilizer. When added to water, it forms a homogenous slurry. When sprayed on the ground, will form a blotterlike cover impregnated uniformly with grass seed. The cover will allow the absorption of moisture and allow rainfall or applied water to percolate to the underlying soil. The shrinkage after wetting shall not exceed 20 percent of the surface area.

## **PART 3 EXECUTION**

### **3.1 SODDING TIMES**

#### **3.1.1 Sodding Time**

Sodding operations shall take place between March 1 and Nov. 30, inclusive.

#### **3.1.2 Temporary Winter Cover Planting Time**

When the completion schedule of the work under the contract requires a delay in sodding operations due to the limitation dates above, the areas not yet sodded or which do not have a vegetative cover shall be seeded immediately with a temporary winter cover.

### **3.2 SITE PREPARATION**

#### **3.2.1 Preparation of Sodding Areas**

##### **3.2.1.1 Grading**

The placing of topsoil and smooth grading shall be completed as specified herein and in accordance with Section 02210. The finished grades indicated on the drawings shall be approved prior to sodding.

##### **3.2.1.2 Unsatisfactory Environmental Conditions**

Site preparation work shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture or other unsatisfactory condition prevails, the work shall be stopped when directed.

#### **3.2.2 Application of Soil Amendments**

##### **3.2.2.1 Soil Test**

A soil test shall be performed for pH, chemical analysis and mechanical analysis to establish the quantities and type of soil amendments required to meet local growing conditions for the type and variety of turf specified.

##### **3.2.2.2 Lime**

Lime shall be applied at the rate as recommended by the soil test. Lime shall be incorporated into the soil to a minimum depth of 4-inches or may be incorporated as part of the tillage operation.

##### **3.2.2.3 Fertilizer**

Fertilizer shall be applied at the rate as recommended by the soil test. Fertilizer shall be incorporated into the soil to a minimum depth of 4-inches or may be incorporated as part of the tillage or hydroseeding operation.

##### **3.2.2.4 Deviations**

Deviations in the ground surface in relation to the grades indicated shall be corrected prior to grassing.

### **3.2.3 Topsoil**

Topsoil shall be distributed uniformly and spread evenly to an average thickness of 3-inches, with a minimum thickness of 2-inches. Topsoil shall be spread so that planting can proceed with little additional soil preparation or additional tillage. Surface irregularities resulting from topsoiling or other operations shall be leveled to prevent depressions. Grade shall be adjusted to assure that planted grade will be 1-inch below adjoining grade of any surfaced area. New surfaces shall be blended into existing areas. Soil compacted by construction equipment or soil on compacted cut slopes of grades shall be pulverized to a minimum depth of 2-inches by disking or plowing before applying topsoil.

### **3.2.4 Tillage**

#### **3.2.4.1 Minimum Depth**

Soil shall be tilled to a minimum depth of 4-inches by plowing, disking, harrowing, rototilling or other method. On slopes 2 horizontal to 1 vertical and steeper, the soil shall be tilled to a minimum depth of 2-inches by scarifying with heavy rakes, or other method. Rototillers shall be used where soil conditions and length of slope permit. On slopes 1 horizontal to 1 vertical and steeper, no tillage is required.

#### **3.2.4.2 Applying Lime and Fertilizer**

Lime and fertilizer, as specified, may be applied during tillage.

### **3.2.5 Finished Grading**

#### **3.2.5.1 Preparation**

Turf areas shall be filled as needed or have surplus soil removed to attain the finished grade. Drainage patterns shall be maintained as indicated on drawings. Turf areas compacted by construction operations shall be completely pulverized by tillage. Soil used for repair of erosion or grade deficiencies shall conform to topsoil requirements specified in this section. Finished grade shall be 1-inch below the adjoining grade of any surfaced area. New surfaces shall be blended to existing areas.

#### **3.2.5.2 Debris, 1-Inch**

Lawn areas shall have debris and stones larger than 1-inch in any dimension removed from the surface.

#### **3.2.5.3 Debris, 3-Inch**

Field areas shall have debris and stones larger than 3-inches in any dimension removed from the surface.

#### **3.2.5.4 Protection**

Finished graded areas shall be protected from damage by vehicular or pedestrian traffic and erosion.

### **3.2.6 Application of Pesticides**

When treatment becomes necessary to remove a pest, a state certified pesticide applicator shall apply required chemicals in accordance with EPA



label restrictions and recommendations. Hydraulic equipment shall be provided for the liquid application of chemicals with a leak-proof tank, positive agitation methods, controlled application pressure and metering gauges.

### **3.3 SODDING**

#### **3.3.1 General**

Areas shall be sodded as indicated. Sod shall be placed in accordance with the ASPA-01 in the areas indicated. The time limitation between harvesting and placing sod is 36 hours. Sod that has become dry, moldy or yellow from heating will be rejected.

#### **3.3.2 Placing Sod**

Adequate soil moisture shall be ensured prior to sodding by spraying water on the area to be sodded and wetting the soil to a minimum depth of 4-inches. On long slopes sod shall be laid at right angles to slopes. In ditches sod shall be laid at right angles to the flow of water. When required, the sod shall be anchored by placing anchors a minimum distance of 2 feet on center with a minimum of 2 anchors per sod section. Sod shall be laid smoothly edge to edge with staggered joints. No gaps larger than 1-inch shall exist between sod joints.

#### **3.3.3 Finishing**

Air pockets shall be eliminated and a true and even surface shall be provided by tamping or rolling the sod in place. Frayed edges shall be trimmed and holes or missing corners shall be patched with sod.

#### **3.3.4 Temporary Winter Cover**

When the completion schedule of the work under the contract requires a delay in grassing operations due to the limitation dates in paragraph 3.1 above, the areas which do not have a vegetative cover shall be seeded immediately with a temporary winter cover to prevent erosion.

All areas shall be seeded with annual ryegrass. The temporary winter cover planting shall include the application of 1/2 the quantity of required soil amendments in the paragraph 3.2, "SITE PREPARATION", with the remaining 1/2 to be included with the permanent grassing operations. The areas to be seeded with a temporary winter cover shall be tilled prior to seeding with the mixture in the same manner as specified in paragraph 3.2, "SITE PREPARATION".

Areas provided with the temporary cover shall be tilled prior to resuming permanent grassing operations.

#### **3.3.5 Temporary Winter Protection**

When the completion schedule of the work under the contract requires a delay in grassing operations due to the limitation dates in paragraph 3.1 above, the areas which do not have a vegetative cover shall be either seeded immediately with a temporary winter grass, mulched with straw or hay tacked with an asphalt adhesive, or covered with an erosion control blanket material.

The temporary winter grass planting shall include the application of 1/2 the quantity of required soil amendments in the paragraph "SITE PREPARATION", with the remaining 1/2 to be included with the permanent grassing operations. The areas to be seeded with a temporary winter grass cover shall be tilled prior to seeding with the mixture in the same manner as specified in paragraph "SITE PREPARATION". The straw or hay tacked with an asphalt adhesive shall be

spread by a blower-type mulch spreader so equipped that straw or hay will be ejected simultaneously with asphalt adhesive. Erosion control blanket material shall be installed and properly anchored in accordance with manufactures recommendations. Areas which have been provided with temporary winter protection shall be thoroughly tilled prior to resuming permanent grassing operations. Erosion control blanket material placed as temporary winter protection may be removed prior to tillage operations.

### **3.4 RESTORATION AND CLEAN UP**

Excess and waste material shall be removed and disposed of off the site. Adjacent paved areas shall be cleaned. Existing turf areas which have been damaged during the contract operations shall be restored to original conditions.

### **3.5 PROTECTION OF TURFED AREAS**

Immediately after turfing, the area shall be protected against traffic or other use by erecting barricades and providing signage as required or as directed by the Contracting Officer's representative.

### **3.6 TURF ESTABLISHMENT PERIOD**

#### **3.6.1 Length of Period**

The turf establishment period will begin on the first day of grassing work under this contract and will continue through the remaining life of the contract and end three (3) months after the last day of grass planting required by this contract.

#### **3.6.2 Stand of Turf**

##### **3.6.2.1 Sodding Operation**

A stand of turf from the sodding operation is defined as living sod uniform in color and leaf texture. Bare spots shall be no larger than 6-inches square. The total bare spots shall not exceed 2 percent of the total sodded area.

#### **3.6.3 Maintenance During Establishment Period**

##### **3.6.3.1 General**

Maintenance of the turfed areas shall include mowing, removal of excess clippings, eradicating weeds, eradicating insects and diseases, watering, fertilizing, overseeding and any other operation necessary to promote the growth of sodded grass. Maintenance shall also include protecting embankments and ditches from erosion, maintaining erosion control material, and protecting turfed areas from traffic.

##### **3.6.3.2 Repair**

When any portion of the surface becomes gullied or otherwise damaged or treatment is destroyed, the affected portion shall be repaired to reestablish condition and grade of soil and treatment prior to injury, as directed. Repair work required because of faulty operations or negligence on the part of the Contractor shall be performed without cost to the Government. Mulch shall be repaired or replaced as required.

#### **3.6.3.3 Mowing**

The Contractor shall mow sodded areas to a minimum height of 2 1/2 inches when the average height of the turf becomes 3 inches. Following the initial mowing operation, the Contractor shall mow newly grassed areas at one week intervals; reducing the height of the grass by not more than 1/3 the height prior to each mowing operation.

#### **3.6.3.4 Post-Fertilization**

Fertilizer shall be applied during the 3rd month of the 3-month establishment period. Fertilizer having an analysis of 13-13-13 shall be applied at the rate of 50 pounds per acre at each application. A thorough application of water shall be applied immediately after each application of fertilizer.

#### **3.6.3.5 Pesticide Treatment**

When a pest or disease becomes apparent during the Turf Establishment Period, a state certified pesticide applicator shall apply required pesticide in accordance with EPA label restrictions and recommendations.

### **3.7 FINAL ACCEPTANCE**

At the end of the Turf Establishment Period, a final inspection will be made. Final acceptance of the turf will be based upon a satisfactory stand of turf as defined in the paragraph 3.6, "TURF ESTABLISHMENT PERIOD." Rejected areas shall be replanted or repaired as directed by the Contracting Officer's representative.

-- End of Section --

## SECTION 02950

### TREES, SHRUBS, GROUND COVERS, AND VINES

#### PART I. GENERAL

##### 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF NURSERYMEN (AAN)

AAN-01 (1990) American Standard for Nursery Stock

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2607 (1969) Peats, Mosses, Humus, and Related Products

##### 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL PROCEDURES:

SD-01 Data

The following work plans, before work is started.

- a. Delivery Schedule at least 10 days prior to the intended date of the first delivery.
- b. Pesticide Treatment Plan, giving proposed sequence of pesticide treatment work, before work is started. The pesticide trade name, chemical composition, formulation, concentration, application rate of active ingredients and methods of application for all materials furnished, and the name and state license number of the state certified applicator shall be included.

Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

- a. Topsoil: For pH, chemical analysis, mechanical analysis and particle size.
- b. Fertilizer: For chemical analysis and composition percent.
- c. Agricultural Limestone: For sieve analysis and calcium carbonate equivalent.
- d. Peat: For compliance with ASTM D 2607.
- e. Plant Materials: For botanical and common name, size, quantity by species, grade, nursery grown.

## Maintenance Instructions; GA; CD

- a. Maintenance Report. Written record of maintenance work performed and quantity of plant losses and replacements.
- b. Plant Establishment Period. Written calendar time period for the beginning of the plant establishment period. When there is more than one establishment period, the boundaries of the planted areas covered for each period shall be described.
- c. Maintenance Instruction. Written instructions for year-round care of installed plants.

### **1.3 SOURCE INSPECTIONS**

#### **1.3.1 Plant Materials**

Plant materials shall be subject to inspection at the growing site by the Contracting Officer's representative.

#### **1.3.2 Delivered Topsoil**

The source of topsoil shall be subject to inspection by the Contracting Officer's representative.

### **1.4 SHIPMENT, DELIVERY, INSPECTION, STORAGE, AND HANDLING**

#### **1.4.1 Shipment**

##### **1.4.1.1 Preparation**

Digging and preparation for shipment shall be done in a manner that will not cause shock or damage to branches, trunk, or root systems.

a. Balled and Burlapped (BB) Plants: Ball size and ratio shall be provided as recommended by AAN-01. The ball shall be of a diameter and depth to encompass enough fibrous and feeding root system necessary for the full recovery of the plant. Removal shall be accomplished by hand digging or mechanical devices. Center the plant stem or trunk in the ball and clean cut all roots at the ball surface. No roots shall be pulled from the ground. The root ball shall be completely wrapped with burlap or other suitable material and securely laced with twine.

b. Container-Grown (C) Plants: Container size shall be provided as recommended by AAN-01. Plants shall be grown in a container sufficiently long for new fibrous roots to have developed and for root mass to retain its shape and hold together when removed from container. Container shall be sufficiently rigid to hold ball shape and protect root mass during shipping.

#### **1.4.2 Delivery**

##### **1.4.2.1 Identification**

Plants shall be identified with durable waterproof labels and weather-resistant ink. Plants shall have attached labels stating the correct plant name and size.

#### **1.4.2.2 Protection During Delivery**

Plants shall be protected during delivery to prevent desiccation of the plant or damage to the roots or balls. Branches of plants shall be protected by tying-in the branches and covering all exposed branches.

#### **1.4.2.3 Topsoil**

A soil test shall be provided for topsoil delivered to the site.

#### **1.4.2.4 Soil Amendments**

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

#### **1.4.3 Inspection**

Plant material shall be inspected upon arrival at the jobsite by the Contracting Officer's representative for conformity to the paragraph PLANTS and paragraph Shipment, and any unacceptable plant material shall be removed from the jobsite.

#### **1.4.4 Storage**

##### **1.4.4.1 Plant Storage**

Plants not installed on the day of arrival at the site shall be stored and protected in areas designated by the Contracting Officer's representative. Plants shall be protected from exposure to wind and shall be shaded from the sun. Covering that will allow air to circulate and prevent internal heat from building up shall be provided. Bare-root plants shall be heeled-in. All plants shall be kept in a moist condition by watering with a fine mist spray until planted.

##### **1.4.4.2 Storage of Other Materials**

Soil amendments shall be stored in dry locations away from contaminants. Pesticide materials shall not be stored with other landscape materials. Storage of materials shall be in areas designated or as approved by the Contracting Officer's representative.

#### **1.4.5 Handling**

Care shall be taken to avoid injury to plants. Materials shall not be dropped from vehicles. Balled and burlapped plants shall be handled carefully to avoid cracking or breaking the earth ball and container-grown plants shall be handled by the container. Plants shall not be handled by the trunk or stems.

##### **1.4.5.1 Time Limitation**

- a. Mulch: Limitation of time between installing plant and placing mulch is 48 hours.
- b. Transplanting Existing Plants: Limitation of time between digging and replanting existing plant material is one hour.

## **1.5 WARRANTY**

Furnished plants shall be guaranteed to be in a vigorous growing condition for a period of 12 months regardless of the contract time period. A plant shall be replaced one time under this guarantee. Transplanted existing plants require no guarantee. A written calendar time period for the guarantee of plant growth shall be furnished to the Contracting Officer's representative.

## **PART 2 PRODUCTS**

### **2.1 PLANTS**

#### **2.1.1 Varieties**

Plants shall be nursery grown or plantation grown stock conforming to AAN-01 and shall be of the varieties specified in the plant list bearing botanical names listed in one or more of the publications listed under "Nomenclature" in AAN-01.

#### **2.1.2 Substitutions**

Substitutions will not be permitted without written request from the Contractor for approval by the Contracting Officer's representative.

#### **2.1.3 Growing Conditions**

Plants shall be grown under climatic conditions similar to those in the locality of the project.

#### **2.1.4 Quality**

Well shaped, well grown, vigorous, healthy plants having healthy and well branched root systems shall be provided. Plants shall be provided free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement and abrasion. Plants shall be provided that are typical of the species or variety and conforming to standards as set forth in AAN-01 and as specified herein.

##### **2.1.4.1 Shade and Flowering Trees**

A height relationship to caliper shall be provided as recommended by AAN-01. Height of branching should bear a relationship to the size and variety of tree specified and with the crown in good balance with the trunk. Trees shall not be "poled" or the leader removed.

a. Single stem: Trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.

b. Multi-stem: All countable stems, in aggregate, shall average the size specified. To be considered a stem, there should be no division of the trunk which branches more than six inches from ground level.

c. Specimen: A plant shall be provided that is well branched and pruned naturally according to the species. The form of growth desired, which may not be in accordance with natural growth habit, shall be as indicated.

##### **2.1.4.2 Deciduous Shrub**

Plants shall be provided that have the height and number of primary stems as recommended by AAN-01. An acceptable plant shall be well shaped with

sufficient well-spaced side branches recognized by the trade as typical for the variety grown in the region.

#### **2.1.4.3 Coniferous Evergreen**

Trees shall be provided that have the height-to-spread ratio as recommended by AAN-01. Trees shall not be "poled" or the leader removed. An acceptable plant shall be exceptionally heavy, well shaped and trimmed to form a symmetrical and tightly knit plant. The form of growth desired shall be as indicated.

#### **2.1.4.4 Broadleaf Evergreen**

Plants shall be provided that have ratio of height-to-spread as recommended by AAN-01. An acceptable plant shall be well shaped and recognized by the trade as typical for the variety grown in the region.

#### **2.1.4.5 Groundcovers and Vines**

Plants shall be provided with the minimum number of runners and length of runner as recommended by AAN-01. Plants shall be furnished that have heavy, well developed and balanced top with vigorous well developed root system and shall be furnished in containers.

#### **2.1.5 Size**

Plants shall be furnished in sizes indicated. Plants larger in size than specified may be provided at no additional cost to the Government.

#### **2.1.6 Measurement**

Plant measurements shall be in accordance with AAN-01.

### **2.2 TOPSOIL**

Topsoil shall be the existing surface soil stripped to the depth indicated and stockpiled on the site in accordance with Section 02210 GRADING. Additional topsoil, if required, beyond that available from stripping operations, shall be delivered. Delivered topsoil shall conform to topsoil requirement specified in Section 02210 GRADING and shall be amended as recommended by soil tests for the plants specified.

#### **2.2.1 Soil Test**

A soil test shall be performed for pH, particle size, chemical analysis and mechanical analysis to establish the quantities and type of soil amendments required to meet local growing conditions for the type and variety of plants specified.

### **2.3 SOIL AMENDMENTS**

Soil amendments consist of lime, fertilizer, and bonemeal.

#### **2.3.1 Lime**

Lime shall be agricultural limestone and shall have a minimum calcium carbonate equivalent of 90 percent and shall be ground to such a fineness that at least 90 percent will pass a 10-mesh sieve and at least 50 percent will pass a 60-mesh sieve.



### **2.3.2 Fertilizer**

Fertilizer shall be commercial grade, free flowing, uniform in composition and conforming to CID A-A-1909.

#### **2.3.2.1 Dry Fertilizer**

a. Granular fertilizer : Consists of nitrogen-phosphorous-potassium ratio: 13 percent nitrogen 13 percent phosphorous, and 13 percent potassium.

#### **2.3.2.2 Organic Soil Amendments**

##### **2.3.2.3 Peat**

Peat shall be a natural product of peat humus derived from a bog, swampland or marsh and shall conform to ASTM D 2607.

##### **2.3.2.4 Sand**

Sand shall be clean and free of toxic materials and at least 95 percent by weight shall pass a 10-mesh sieve, and 10 percent by weight shall pass a 16-mesh sieve.

##### **2.3.2.5 Gypsum**

Gypsum shall be commercially packaged, free flowing, and a minimum of 95 percent calcium sulfate by volume.

### **2.4 MULCH**

Mulch shall be free from weeds, mold and other deleterious materials.

#### **2.4.1 Organic Mulch Material**

Organic mulch materials shall be pine needles.

### **2.5 GUYING AND STAKING MATERIAL**

#### **2.5.0.1 Bracing Stakes**

Bracing stakes shall be a minimum of 2 inches by 2 inches in diameter by 8 feet long and pointed at one end.

#### **2.5.1 Guying Material**

##### **2.5.1.1 Guying Wire**

Guying wire shall be 12-gauge annealed galvanized steel wire.

##### **2.5.2 Flags**

Flags to be fastened to guys shall be white surveyor's plastic tape, 6 inches in length.

### **2.6 WATER**

Water shall not contain elements toxic to plant life.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

#### **3.1.1 Verify Grades**

The Contracting Officer's representative shall verify the finished grades are as indicated on drawings, and the placing of topsoil and smooth grading has been completed in accordance with Section 02210 GRADING.

#### **3.1.2 Underground Obstructions to Planting**

The location of underground utilities and facilities shall be verified. Damage to underground utilities and facilities shall be repaired at the Contractor's expense.

### **3.2 SITE PREPARATION**

#### **3.2.1 Layout**

Plant material locations and bed outlines shall be staked on the project site before any excavation is made. Plant material locations may be adjusted by the Contracting Officer's representative to meet field conditions.

#### **3.2.2 Protection of Existing Vegetation**

If lawns have been established prior to planting operations, the surrounding turf shall be covered before excavations are made in a manner that will protect turf areas. Existing trees, shrubbery, and beds that are to be preserved shall be barricaded in a manner that will effectively protect them during planting operations.

### **3.3 EXCAVATION**

#### **3.3.1 Obstructions Below Ground or Poor Drainage**

When obstructions below ground or poor drainage affect the contract operation, proposed adjustments to plant location, type of plant and planting method or drainage correction shall be submitted to and approved by the Contracting Officer's representative.

#### **3.3.2 Turf Removal**

Where planting beds occur in existing turf areas, the turf shall be removed to a depth that will ensure the removal of the entire root system.

#### **3.3.3 Plant Pits**

Plant pits shall be dug to produce vertical sides and flat, uncompacted bottoms. When pits are dug with an auger and the sides of the pits become glazed, the glazed surface shall be scarified. The size of plant pits shall be as shown. The minimum allowable dimensions of plant pits shall be 6 inches deeper than the depth of ball or the depth of base roots; pit diameters shall be 2 feet greater than the ball root spread.

#### **3.3.4 Planting Conditions**

Planting operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture or other

unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant a variance to the planting operations, proposed planting times shall be submitted to and approved by the Contracting Officer's representative.

### **3.4 INSTALLATION**

#### **3.4.1 Backfill Soil Mixture**

The backfill soil mixture shall be a proportioned mixture thoroughly mixed by volume of topsoil and selected soil amendments as follows:

75 percent to mixture with ground pine bark, 25% of mixture.

#### **3.4.2 Setting Plants**

Plants shall be set plumb and held in position until sufficient soil has been firmly placed around roots or ball. Plants shall be set in relation to surrounding grade so that they are even with the depth at which they were grown in the nursery, or container.

#### **3.4.3 Controlled-Release Fertilizer**

Controlled-release fertilizer shall be placed in packet or tablet form in the plant pit in the immediate vicinity of the feeding roots in accordance with the manufacturer's recommendations.

#### **3.4.4 Balled and Burlapped Plants**

Materials shall be removed that are metal, plastic, nylon or treated burlap, prior to backfilling. Balled and burlapped stock shall be backfilled with topsoil to approximately half the depth of the ball and then tamped and watered. Biodegradable burlap and tying material shall be carefully opened and folded back. The backfill shall be completed, tamped and watered. A 4-inch high earth saucer shall be formed around individual plants.

#### **3.4.5 Bare-Root Plants**

Bare-root plants shall be installed by arranging the roots in a natural position. Damaged roots shall be removed with a clean cut. Bare-root (BR) plants shall be backfilled with topsoil carefully worked in among the roots. The backfill and water shall be completed. A 4-inch high earth saucer shall be formed around individual plants.

#### **3.4.6 Container-Grown, Balled and Platformed and Balled and Potted Plants**

Non-biodegradable containers or platforms shall be removed without damage to the plant or root system. Biodegradable containers shall be split. The backfill shall be completed as specified for BB plants.

#### **3.4.7 Groundcover Bed**

##### **3.4.7.1 Plant Beds in Existing Soil**

Bed shall be tilled to a minimum depth of 6 inches where existing soil is to be used in-place. Selected soil amendments shall be spread uniformly over the bed. Selected soil amendments shall be a proportioned mixture as follows:

25 percent to mixture.

The mixture shall be thoroughly incorporated into the soil to a minimum depth of 36 inches using a roto-tiller or other method to obtain a uniform and well

pulverized soil mix. All sticks, stones, roots and other objectionable materials shall be removed from the surface. The bed shall be brought to a smooth and even surface blending to existing areas.

#### **3.4.7.2 Plant Beds in Replaced Soil**

When soil replacement is required, the existing soil shall be excavated and removed to a minimum depth of 6 inches and topsoil shall be placed on previously scarified subsoil to a minimum depth of 6 inches. The bed shall be brought to a smooth and even surface blending to existing areas. Settlement shall be allowed for.

#### **3.4.7.3 Groundcover**

Groundcover may be planted after the mulch is in place. Contaminating the mulch with soil shall be avoided.

#### **3.4.8 Transplanting Existing Plants**

Existing plant material to be transplanted shall be tagged on the site and/or as indicated. Existing plants shall be removed from the ground by means of mechanical devices or other method with a ball attached, meeting the requirements of paragraph SHIPMENT.

#### **3.4.9 Staking and Guying**

##### **3.4.9.1 Two Bracing Stakes**

Trees over 6 feet tall shall be held in place with two bracing stakes placed on opposite sides. The tree shall be held firmly between the stakes with a double strand of wire. Chafing guards shall be used where the wire contacts the tree. Bracing stakes shall be driven vertically into firm ground and shall not injure the ball or roots.

##### **3.4.10 Flags**

A flag shall be securely fastened to each guying line to be visible by pedestrians.

### **3.5 FINISHING**

#### **3.5.1 Plant Beds**

Planted areas shall be uniformly edged to provide a clear-cut division line between the planted area and the adjacent turf area and to provide a shape as indicated. The entire planted area shall be raked and smoothed while maintaining the earth saucers.

#### **3.5.2 Pruning**

The total amount of foliage shall be pruned by one-fourth to one-third on installed trees and shrubs to compensate for loss of roots and transplanting shock. The typical growth habit of individual plants shall be retained. Clean cuts shall be made flush with the parent trunk. Improper cuts, stubs, dead and broken branches shall be removed. "Headback" cuts at right angles to the line of growth shall not be permitted. Trees shall not be poled or the leader removed, nor shall the leader be pruned or "topped off."

### **3.5.3 MULCH**

Mulch shall be spread to a uniform thickness of 4 inches within 48 hours after planting. Mulch shall be kept out of the crowns of shrubs and off buildings, sidewalks and other facilities.

### **3.6 MAINTENANCE DURING PLANTING OPERATION**

Installed plants shall be maintained in a healthy growing condition. Maintenance operations shall begin immediately after each plant is installed and shall continue until the plant establishment period commences. The maintenance includes watering, pruning, wound dressing, straightening and other necessary operations. Plant beds and earth saucers shall be kept free of weeds, grass and other undesired vegetation. Plants shall be checked for settlement and shall be reset proper grade as necessary. Run-off, puddling and wilting shall be prevented.

### **3.7 CARE OF EXISTING PLANT MATERIAL**

#### **3.7.1 Identification**

Existing plant material to be treated shall be tagged on the site and/or as indicated.

#### **3.7.2 Fertilizing Existing Trees**

Holes shall be dug by hand or mechanical devices, a minimum 1-1/2 inches in diameter and 18 inches deep, distributed evenly at not more than 2 feet on center throughout the outer half of the branch spread zone of each tree.

##### **3.7.2.1 Dry Fertilizer**

Dry fertilizer shall be placed in the hole to within 4 inches of the surrounding grade.

##### **3.7.2.2 Application**

Packet, tablet or wedge-form fertilizer shall be applied in accordance with manufacturer's recommendations.

##### **3.7.2.3 Backfill**

Topsoil or sand shall be used as backfill in the hole and shall be blended to the surrounding grade.

### **3.8 APPLICATION OF PESTICIDE MATERIAL**

When pesticide becomes necessary to remove a disease or pest, a state-certified applicator shall apply required pesticide in accordance with State EPA label restrictions and recommendations. Hydraulic equipment shall be provided for the liquid application of pesticides with a leak-proof tank, positive agitation methods, controlled application pressure and metering gauges. A pesticide treatment plan shall be provided to the Contracting Officer's representative as specified in paragraph SUBMITTALS.

### **3.9 RESTORATION AND CLEAN UP**

#### **3.9.1 Restoration**

Turf areas, pavements and facilities that have been damaged from the planting operation shall be restored to original condition at the Contractor's expense.

### **3.9.2 Clean Up**

Excess and waste material from the planting operation shall be removed and disposed of off the site. Adjacent paved areas shall be cleared.

### **3.10 PLANT ESTABLISHMENT PERIOD**

#### **3.10.1 Commencement**

On completion of the last day of the planting operation, the plant establishment period for maintaining installed plants in a healthy growing condition shall commence and shall be in effect for the remaining contract time period not to exceed 12 months. When the planting operation extends over more than one season or there is a variance to the planting times, plant establishment periods shall be established for the work completed, as directed. Written calendar time period shall be furnished to the Contracting Officer's representative for the beginning of the plant establishment period. When there is more than one plant establishment period, describe the boundaries of the planted area covered for each period.

#### **3.10.2 Maintenance During Establishment Period**

##### **3.10.2.1 General**

Maintenance of plants shall include straightening plants, tightening stakes and guying material, repairing tree wrapping, protecting plant areas from erosion, maintaining erosion control material, supplementing mulch, accomplishing wound dressing, removing dead or broken tip growth by pruning, maintaining edging of beds, checking for girdling of plants and maintaining plant labels, watering, weeding, removing and replacing unhealthy plants.

##### **3.10.2.2 Water**

The plants shall be watered as necessary to maintain an adequate supply of moisture within the root zone. An adequate supply of moisture is estimated to be the equivalent of one inch of absorbed water per week delivered in the form of natural rain or augmented as required by periodic waterings. Run-off, puddling and wilting shall be prevented.

##### **3.10.2.3 Weeding**

Grass and weeds in earth saucers and plant beds shall not be allowed to reach a height of 3 inches before being completely removed, including the root growth.

##### **3.10.2.4 Unhealthy Plants**

A plant shall be considered unhealthy or dead when the main leader has died back, or 25 percent of the crown is dead. Determine the cause for an unhealthy plant. Unhealthy or dead plants shall be removed immediately and shall be replaced as soon as seasonal conditions permit.

##### **3.10.2.5 Fertilizing**

The plants shall be topdressed at least once during the period of establishment with dry fertilizer at the rate of 25% pounds per 100 square feet of plant pit or bed area or foliar feed plants with liquid fertilizer. Dry fertilizer adhering to plants shall be flushed off. The application shall be timed prior to the advent of winter dormancy.

#### **3.10.2.6 Settlement**

Topsoil shall be added to maintain grade and to maintain earth saucers. Serious settlement affecting the setting of the plant in relation to the depth at which it was grown requires replanting in accordance with paragraph INSTALLATION.

#### **3.10.2.7 Maintenance Report**

A written record shall be furnished to the Contracting Officer's representative of the maintenance work performed, the quality of plant losses, cause for plant loss and replacements made on each site visit.

#### **3.10.2.8 Maintenance Instructions**

Written instructions shall be furnished to the Contracting Officer's representative for year-round care of installed plants.

#### **3.10.3 Replacement Plants**

Plants shall be provided for replacement in accordance with paragraph PLANTS. Replacement plants shall be installed in accordance with paragraph INSTALLATION. No extended plant establishment period shall be required for replacement plants. A plant will be replaced in accordance with paragraph WARRANTY.

### **3.11 FINAL ACCEPTANCE**

#### **3.11.1 Preliminary Inspection**

Prior to inspection shall be held by the Contracting Officers representative. Time for the inspection will be established in writing. The quantity and type of plants installed and the acceptability of the plants in accordance with the plant establishment period shall be determined.

#### **3.11.2 Final Inspection**

A final inspection shall be held by the Contracting Officer's representative to determine that deficiencies noted in the preliminary inspection have been corrected. Time for the inspection shall be established in writing. Acceptance of the planting operation is subject to the guarantee of plant growth.

--End of Section--

## SECTION 05255

### NONBEARING EXTERIOR INSULATION AND FINISH SYSTEM (EIFS) VENEER/STEEL STUD WALLS

#### PART 1 GENERAL

##### 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

#### AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG-671 (1986; Addenda 1989; Errata Nov 30, 1990)  
Specification for the Design of Cold-Formed  
Steel Structural Members (Part I of the  
Cold-Formed Steel Design Manual)

#### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123 (1989a) Zinc (Hot-Dip Galvanized) Coatings on  
Iron and Steel Products

ASTM A 153 (1982; R 1987) Zinc Coating (Hot-Dip) on Iron  
and Steel Hardware

ASTM A 446 (1993) Steel Sheet, Zinc-Coated (Galvanized) by  
the Hot-Dip Process, Structural (Physical)  
Quality

ASTM A 525 (1993) General Requirements for Steel Sheet,  
Zinc-Coated (Galvanized) by the Hot-Dip Process

ASTM C 665 (1991) Mineral-Fiber Blanket Thermal Insulation  
for Light Frame Construction and Manufactured  
Housing

ASTM C 955 (1994) Load-Bearing (Transverse and Axial) Steel  
Studs, Runners (Tracks), and Bracing or Bridging  
for Screw Application of Gypsum Board and Metal  
Plaster Bases

#### AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING (ASHRAE)

ASHRAE-03 (1993; Errata) Handbook, Fundamentals I-P  
Edition

#### DEPARTMENT OF COMMERCE (DOC)

DOC PS 1 (1983) Construction and Industrial Plywood



## **1.2 DELIVERY, HANDLING AND STORAGE**

Materials shall be delivered and handled in a manner to avoid bending or other damage and to avoid contact with soil or other contaminating materials. Finish of the framing members shall be maintained at all times, using an approved high zinc dust content galvanizing repair paint whenever necessary to prevent the formation of rust. Insulation and moisture barrier shall be stored in dry, well ventilated, weather-tight areas protected from sunlight and excessive heat. Air infiltration type vapor barrier shall be stored in accordance with the manufacturer's recommendations.

## **PART 2 PRODUCTS**

### **2.1 COLD-FORMED STEEL FRAMING**

Cold-formed framing shall consist of steel studs, top and bottom tracks, runners, horizontal bridging, and other cold-formed members and other accessories. The cold-formed framing system shall be designed in accordance with AISI SG-671. The steel studs and other cold-formed steel framing members within the wall shall be designed to resist the entire wind loadings acting inward and outward perpendicular to the wall system without exceeding a deflection of 1/600 times the vertical stud span and AISI SG-671 allowable stresses. To prevent the masonry wythe from cracking due to "hard spot" support at doors, windows, and other openings, the completed design of the cold-formed steel system shall result in bending stiffnesses and deflections at openings that are compatible with those away from wall openings. Design calculations shall be submitted for approval. All members and components made of sheet steel shall be hot-dip galvanized in accordance with ASTM A 525 with a minimum coating thickness of G 60. Framing covered herein shall be used only in framing the exterior insulation and finish system (EIFS) steel stud wall system as indicated on the drawings. Metal framing for interior partitions are specified in Section 09250 GYPSUM WALLBOARD.

#### **2.1.1 Steel Studs**

Studs will conform to ASTM A 446, Grade A, having a minimum yield strength of 33,000 psi. Studs shall be cold-formed from 0.048 inch minimum base metal thickness steel. The base metal thickness of studs shall be 0.0478 inches except where noted otherwise on the construction drawings. Studs shall be 4 inches deep and shall have a minimum flange width of 1-5/8 inches with a minimum return lip of 0.25 inches. Section properties shall be determined in accordance with AISI SG-671.

#### **2.1.2 Runners, Tracks, Bridging and Accessories**

All cold-formed steel sheet framing members, components, and accessories, other than the steel studs, shall conform to ASTM C 955 and be of steel conforming to ASTM A 446, Grade A, having a minimum yield strength of 33,000 psi.

### **2.2 INSULATION**

#### **2.2.1 Blanket Insulation**

Insulation placed between the steel studs shall be batt or blanket type mineral wool conforming to ASTM C 665, Type III.

### **2.3 GYPSUM WALLBOARD**

Gypsum wallboard that is installed on the interior side of the cold-formed steel framing system shall be as specified in Section 09250 GYPSUM WALLBOARD.

## **2.4 EXTERIOR SHEATHING**

Exterior sheathing shall be exterior cement board as specified in section 07240 Exterior Insulation and Finish System.

## **2.5 CONNECTIONS**

Screws, bolts and anchors shall be hot-dip galvanized in accordance with ASTM A 123 or ASTM A 153 as appropriate.

### **2.5.1 Framing Screws, Bolts and Anchors**

Screws, bolts and anchors used in the assembly of the cold-formed steel framing system shall be as required by design of the framing system for the specified loading.

## **PART 3 EXECUTION**

### **3.1 GENERAL INSTALLATION REQUIREMENTS**

Wall sections, types of construction and dimensions shall be as shown. Metal door and window frames and other special framing shall be built and anchored into the wall system as indicated.

### **3.2 STEEL STUD WALL FRAMING**

The top track of the stud wall system shall be slip jointed to accommodate vertical deflections of the supporting members. Top and bottom tracks shall be securely anchored to resist track rotation by alternating fastener locations to provide two rows, one row near each track flange. Both flanges of all steel studs shall be securely fastened with screws to the flanges of the top and bottom tracks as shown on the drawings. All details for affixing steel studs to runners and all other sheet steel framing members along with all details necessary for anchorage of the steel stud wall system to the building structural systems shall be shown on the drawings. Horizontal bridging shall be provided as necessary. Studs shall be spaced 16 inches on center. Coordinate stud spacing with sheathing and anchor requirements. At wall openings for doors, windows and other similar features, the framing system shall provide for the installation and anchorage of the required subframes or finish frames. Steel frames shall be securely attached through built-in anchors to the nearest stud on each side of the opening with self-drilling screws. Double studs shall be provided at both jambs of all door openings.

### **3.3 INSULATION**

The actual installed thickness of insulation shall provide a thermal R as indicated on drawings. Installation, except as otherwise specified or shown, shall be in accordance with the manufacturer's instructions. Insulation shall be installed between wall framing members; foil face out. Where electrical outlets, ducts, pipes, vents or other utility items occur, insulation shall be placed on the outside of the item.

### **3.4 GYPSUM WALLBOARD**

Gypsum wallboard shall be installed on the interior face of the cold-formed steel framing system. Installation shall be as specified in Section 09250 GYPSUM WALLBOARD except at vertical slip joints, the gypsum wallboard shall be connected to the vertical studs only so as not to prevent movement at the slip joint.

--End of Section--

## SECTION 05500

### MISCELLANEOUS METAL

#### PART 1 GENERAL

##### 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

##### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	(1993a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 123	(1993a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 446	(1993) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality
ASTM A 500	(1993) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 525	(1993) General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM B 221	(1993) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
ASTM B 429	(1992a) Aluminum-Alloy Extruded Structural Pipe and Tube
ASTM D 2047	(1993) Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine

##### AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(1994) Structural Welding Code - Steel
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##### 1.2 GENERAL REQUIREMENTS

The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. Welding to or on structural steel shall be in accordance with AWS D1.1. Items specified to be galvanized, when practicable and not indicated otherwise, shall be hot-dip galvanized after fabrication. Galvanizing shall be in accordance with ASTM A 123, ASTM A 446, or ASTM A 525, as applicable. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included. Poor matching of holes for fasteners shall be cause for rejection. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Joints exposed to the weather shall be formed to exclude water.

### **1.3 WORKMANSHIP**

Miscellaneous metalwork shall be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Welding shall be continuous along the entire area of contact except where tack welding is permitted. Exposed connections of work in place shall not be tack welded. Exposed welds shall be ground smooth. Exposed surfaces of work in place shall have a smooth finish, and unless otherwise approved, exposed riveting shall be flush. Where tight fits are required, joints shall be milled. Corner joints shall be coped or mitered, well formed, and in true alignment. Work shall be accurately set to established lines and elevations and securely fastened in place. Installation shall be in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

### **1.5 ANCHORAGE**

Anchorage shall be provided where necessary for fastening miscellaneous metal items securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts made to engage with the anchors, expansion shields, and power-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; and lag bolts and screws for wood.

## **PART 2 PRODUCTS**

### **2.1 SHOP PAINTING**

Surfaces of ferrous metal except galvanized surfaces, shall be cleaned and shop coated with the manufacturer's standard protective coating unless otherwise specified. Surfaces of items to be embedded in concrete shall not be painted. Items to be finish painted shall be prepared according to manufacturer's recommendations or as specified.

### **2.2 HANDRAILS**

Handrails shall be designed to resist a concentrated load of 200 pounds in any direction at any point of the top of the rail, or Newtons per 20 pounds per foot applied horizontally to top of the rail, whichever is more severe.

#### **2.2.1 STEEL HANDRAILS**

Steel handrails shall be steel pipe conforming to ASTM A 53 and structural tubing conforming to ASTM A 500, Grade A or B of equivalent strength. Steel handrails shall be 1-1/2 inch nominal size. Railings shall be hot-dip galvanized. Pipe collars shall be hot-dip galvanized steel.

a. Fabrication: Joint posts, rail, and corners shall be fabricated by one of the following methods:

(1) Flush type rail fittings of commercial standard, welded and ground smooth with railing splice locks secured with 3/8 inch hexagonal recessed-head setscrews.

(2) Mitered and welded joints by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding smooth. Railing splices shall be butted and reinforced by a tight fitting interior sleeve not less than 6 inches long.

(3) Railings may be bent at corners in lieu of jointing, provided bends are made in suitable jigs and the pipe is not crushed.

b. Toe-boards and brackets shall be provided as indicated.

c. Woven-wire panels at balcony rails shall be of 10 gauge, 2 inch mesh secured though weaving bar to 1 inch channel frame. Corners of frames shall be mitered and welded or mortised and tenoned.

### **PART 3 EXECUTION**

#### **3.1 GENERAL REQUIREMENTS**

All items shall be installed at the locations shown and according to the manufacturer's recommendations. Items listed below require additional procedures as specified.

#### **3.2 ATTACHMENT OF HANDRAILS**

##### **3.2.1 INSTALLATION OF STEEL HANDRAILS**

Installation shall be in existing pipe sleeves embedded in concrete with pipe sleeve splice to new rail and anchorage covered with standard pipe collar pinned to post. Rail ends shall be secured by steel pipe flanges anchored by expansion shields and bolts.

##### **3.2.2 INSTALLATION OF BALCONY RAILS**

Installation shall be by means of bolted connection to existing studs and welding to existing weld plates.

**--End of Section--**

SECTION 06650  
SOLID POLYMER FABRICATIONS

**PART 1 GENERAL**

**1.1 APPLICABLE PUBLICATIONS**

The publications listed below form a part of this specification to the extent referenced. The Publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) PUBLICATIONS

A136.1-1967                      Organic Adhesives for Installation of Ceramic Tile.

Z124-1980                      Plumbing.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) PUBLICATIONS

D256-84                      Test Methods for Impact Resistance of Plastics and Electrical Insulating Materials.

D570-81                      Test Method for Water Absorption of Plastics.

D638-84                      Test Method for Tensile Properties of Plastics.

D696-79                      Test Method for Coefficient of Linear Thermal Expansion of Plastics.

D1499-84                      Recommended Practice for Operating Light-and-Water Exposure Apparatus (Carbon-Arc Type) for Exposure of Plastics.

E84-84a                      Test Method for Surface Burning Characteristics of Building Materials.

FEDERAL SPECIFICATIONS (FS)

WW-P-541E/GEN                      (GS-FSS) August 1, 1980, Plumbing Fixtures (Lavatories).

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA) PUBLICATIONS

LD3-1980                      High Pressure Decorative Laminates.

**1.2 SCOPE**

Work included in this section are window sills.

**1.3 DELIVERY, STORAGE AND HANDLING**

Materials shall not be delivered to project site until areas are ready for installation. Materials shall be stored indoors and handled to prevent damage to finished surfaces. Protective coverings shall be provided to prevent physical damage or staining following installation, for duration of project.

## PART 2 PRODUCTS

### 2.1 COMPONENTS

Components shall be cast, filled acrylic, not coated, laminated or of composite construction, meeting ANSI Z124-1980 and FS WW-P-541E/GEN. Material shall have minimum physical and performance properties specified. Superficial damage to a depth of 1/10-inch shall be repairable by sanding or polishing.

#### 2.1.1 Materials

Material shall be 1/2 inch thick.

#### 2.1.2 Colors

Colors shall be manufacturer's standard color and indicated in Section 00915 COLOR SCHEDULE. Sheen shall be satin.

#### 2.1.3 Performance Characteristics

<u>PROPERTY</u>	<u>REQUIREMENT</u>	<u>TEST PROCEDURE</u>
Tensile Strength	6000 psi	ASTM D 638-84
Tensile Modulus	1.5 x 10 psi	ASTM D 638-84
Elongation	0.4% min.	ASTM D 638-84
Hardness	94 56	Rockwell "M" scale Barcol Impressor
Gloss (60 degree Gardner)	5-20	ANSI Z 124 - 1980 HUD Bulletin UM-73-84
Color Stability	No change, 200 hours	NEMA LD3-1980
Wear and Cleanability	Passes	ANSI Z 124-1980 HUD Bulletin UM-73-84
Flammability-Sheets		ASTM E84-84a

#### Standard Colors

	<u>1/4 inch*</u>		<u>1/2 inch</u>	<u>3/4 inch</u>
	Masonry	Gypsum		
Flame Spread15	25	5	5	
Smoke Developed	20	25	10	15
Class	I	I	I	I

#### Sierra Colors

	<u>1/4 inch*</u>		<u>1/2 inch</u>	<u>3/4 inch</u>
Flame Spread20		5	5	
Smoke Developed	5		10	15
Class	I		I	

I

\*1/4-inch results reflect material adhered to both masonry surfaces and standard grade 1/2-inch thick gypsum board using panel adhesive for Du Pont CORIAN and tested as a composite.

Water Absorption Weight	24 hrs.	Long Term	ASTM D 570-81
(% Max)	0.04	0.4 (3/4-inch)	
	0.09	0.80 (1/4-inch)	

Izod Impact	0.28 ft.-lbs./in., minimum	ASTM D 256-84 (Method A)
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<u>PROPERTY</u>	<u>REQUIREMENT</u>	<u>TEST PROCEDURE</u>
Impact Resistance-Sheets	No Fracture	NEMA LD3-1980
	1/4-inch slab	
	36-inch drop	1/2 lb. ball
	1/2-inch slab	
	36-inch drop	1 lb. ball
	3/4-inch slab	
	36-inch drop	2 lb. ball
Impact Resistance-Bowls	No cracks or chips	ANSI Z124-1980 HUD Bulletin UM-73-84
Thermal Expansion	3.02 x 10	ASTM D696-79
Boiling Water Surface Resistance	No visible change	NEMA LD3-1980
High Temperature Resistance (5001 F.)	No change	NEMA LD3-1980
Stain Resistance	Passes	ANSI Z124-1980 HUD Bulletin UM-73-84
Weatherability	No change, 1000 hours	ASTM D1499-84
Specific Gravity**	1.8 standard colors	ASTM D570-81

\*\*Approximate weight per square foot for standard colors: 1/4-inch, 2.35 lbs; 1/2-inch, 4.7 lbs.; 3/4-inch, 7.0 lbs. For Sierra colors: 1/4, 2.2 lbs.; 1/2-inch, 4.4 lbs.; 3/4-inch, 6.6 lbs.

## **2.2 ACCESSORY PRODUCTS**

### **2.2.1 Joint Adhesive**

Joint adhesive shall be two-part adhesive kit to create inconspicuous, non-porous joints.

### **2.2.2 Sealant**

Sealant shall be mildew-resistant silicone sealant in colors matching components.



## **2.3            FABRICATION**

Components shall be factory fabricated to the greatest extent practicable to sizes and shapes indicated, in accordance with approved shop drawings. Joints shall be formed between components using manufacturer's standard joint adhesive. Factory cutouts shall be provided for plumbing fittings and bath accessories as indicated on the drawings. Component edges shall be cut and finished with clean, sharp returns. Contours and radii shall be routed to template. Defective and inaccurate work shall be rejected.

## **PART 3        EXECUTION**

### **3.1            INSTALLATION**

#### **3.1.1         Components**

Components shall be installed plumb, level and rigid, scribed to adjacent finishes. Field joints shall be performed using specified adhesives, with joints inconspicuous in the finished work.

--END OF SECTION--

## **SECTION 07240**

### **EXTERIOR INSULATION AND FINISH SYSTEM**

#### **PART I. GENERAL**

##### **1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

##### **AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

ASTM C 578	(1992) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 920	(1987) Elastomeric Joint Sealants
ASTM E 84	(1994a) Surface Burning Characteristics of Building Materials

##### **EIFS INDUSTRY MEMBERS ASSOCIATION (EIMA)**

EIMA 101.86	(1992; Rev May 1994) Resistance of Exterior Insulation and Finish Systems to the Effects of Rapid Deformation (Impact)
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##### **INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)**

ICBO-02	(1994) Uniform Building Code Standards: Uniform Building Code, Vol. III
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##### **1.2 DESCRIPTION**

The exterior insulation and finish system (EIFS) shall be a job-fabricated exterior wall covering consisting of insulation, reinforcing fabric, base coat, finish coat, and accessories. The system shall be the standard product of a manufacturer regularly engaged in furnishing exterior insulation and finish systems and shall be installed by an applicator approved by the system manufacturer. EIFS shall be cementitious, Class PB, with color and finish in accordance with section 09915 color schedule.

##### **1.3 PERFORMANCE REQUIREMENTS**

###### **1.3.1 Test Specimens**

Unless otherwise noted, the test specimens shall consist of reinforcement, base coat and finish coat applied in accordance with the manufacturer's printed recommendations to an insulation board common to the system. These test specimens shall be suitably sized for the apparatus used and be allowed to cure for a minimum of 28 days prior to testing.

###### **1.3.1.1 Flame Spread**

Flame spread test samples consist of base coat, fabric and finish coat, mounted on a non-combustible substrate. When tested in accordance with ASTM E 84, the samples shall have a flame spread rating of 25 or less.

### **1.3.1.2 Full Scale Wall Fire Test**

Full scale wall fire test specimens shall include the complete system with no less than 4 inches of insulation. Test shall be performed in accordance with ICBO-02, Section 17-6. The specimen shall not contribute to significant or horizontal flame spread.

### **1.3.2 Impact Test**

The exterior insulation and finish system shall have been tested in accordance with EIMA 101.86 using a specimen consisting of cured finish system over 1 inch thick insulation with base coat and reinforcing fabric in a complete assembly typical of the project application. Specimen shall withstand an impact of 90-150 inch-pounds.

### **1.3.3 Structural Performance Test**

The system shall have been tested in accordance with ASTM E 330 to minimum 180 PSF positive and 95 PSF negative pressures. Test panels shall be 4 feet by 4 feet minimum, consisting of the typical system assembly.

## **1.4 DELIVERY AND STORAGE**

Materials shall be delivered to the jobsite in their original unopened packages, clearly marked with the manufacturer's name, brand name, and description of contents. Storage shall be in accordance with the manufacturer's recommendations in a clean, dry, well-ventilated area. Stored materials shall be protected from sunlight, and kept away from excessive heat. Coating materials which would be damaged by freezing shall be kept at a temperature not less than 40 degrees F. Insulation board shall not be exposed to flame or other ignition sources.

## **PART 2 PRODUCTS**

### **2.1 EXTERIOR CEMENT BOARD**

Exterior cement board shall be a non-combustible exterior grade portland cement product. Board shall be 4 by 8 feet with a minimum 1/2 inch thickness. Boards shall consist of an aggregated portland cement core faced on both surfaces and wrapped on long edges with an embedded polymer-coated glass fiber mesh. Bonding surface shall have rough texture. Exterior cement board shall comply with the following requirements:

<u>Property</u>	<u>Test Method</u>	<u>Requirement</u>
Flexural Strength	ASTM C 947	750 psi, Min.
Compressive Strength	ASTM D 2394	1250 psi, Min.
Crack Resistance	ASTM E 72	No cracking
Non-combustibility	ASTM E 136	Pass
Flame Spread/Smoke	ASTM E 84	5/0 max.
Water Absorption	ASTM C 948	15 percent max.
Fastener Pull Resistance	ASTM C 473	120 lb min. (wet or dry)

## **2.2 ADHESIVE**

Adhesive shall be the manufacturer's standard product, including primer as required, and shall be compatible with the substrate to which the system is applied.

## **2.3 INSULATION**

Insulation shall conform to ASTM C 578, type as recommended by the system manufacturer and shall be compatible with other system components. Insulation shall be aged a minimum of 6 weeks by air drying, or equivalent prior to installation. Insulation shall be a standard product of the manufacturer and shall be factory marked with the manufacturer's name or trade mark, the material specification number, the R-value at 75 degrees F, and thickness. Thickness of insulation shall be based on specified R-value, but no single layer shall be less than 3/4 inch thick. Boards shall be marked individually. The thermal resistance of insulation in the system shall be not less than the R-value shown on the drawings. Insulation for Class PM and insulation extending below grade shall be restricted to a low water vapor permeability grade of extruded polystyrene (type IV or X).

## **2.4 BASE COAT**

Base coat shall be the manufacturer's standard product and shall be compatible with the finish coat.

## **2.5 REINFORCING FABRIC**

Reinforcing fabric shall be balanced, open weave, glass fiber fabric made from twisted multi-end strands specifically treated for compatibility with the other materials of the system.

## **2.6 MECHANICAL ANCHORS**

Mechanical anchors shall be as recommended by the system manufacturer.

## **2.7 FINISH COATING**

Finish coating shall be manufacturer's standard product, uniform in color and conforming to the following requirements. Specimens for tests shall have been cured for a minimum of 28 days.

TEST	METHOD	RESULTS
Abrasion Resistance	ASTM D 968	528 quarts of sand-slight - smoothing - no loss of film integrity.
Accelerated weathering Light and water exposure	ASTM G 23 or ASTM G 53	2000 hours. No deterioration
Mildew-fungus	ASTM C 1149	Expose for 28 days at 95 resistance percent RH, 90 degrees F temperature. No growth of mildew or fungus.
Salt spray resistance	ASTM B 117	Withstand 300 hours - No deleterious effects.

Water vapor	ASTM E 96	Not more than 18 grains an hour per square foot.
Absorption-freeze (Pre-weighed 4" by 8" specimens; 1" insulation, faced with finish coat cured and stored in air; tested with edges and back open.)	ASTM C 67 50 Cycles: 20 hrs. at -9 degrees C; 4-hr. thaw in water	After 50 cycles - Total weight gain of not more than 6.2 grams. No checking, splitting, or cracking.

## **2.8 SEALANT**

Sealant shall meet requirements of ASTM C 920, Class 25, and shall be compatible with the finish system. Type, Grade, and Use shall be as recommended by both the sealant manufacturer and the system manufacturer. When required, primer, bond breaker and backstop shall be non-staining, and as recommended by the sealant manufacturer and the system manufacturer.

## **2.9 ACCESSORIES**

Accessories shall conform to the recommendations of the system manufacturer and shall include trim, edging, anchors, sealant and filler rod required for proper installation of the system.

## **PART 3 EXECUTION**

### **3.1 SURFACE PREPARATION**

Surface shall be free of oil, loose materials or protrusions which will interfere with the system installation.

### **3.2 ENVIRONMENTAL CONDITION**

Unless a higher temperature is required by the system manufacturer, the ambient air temperature shall be 40 degrees F or greater and rising at the time of installation of the system and shall be predicted to remain at 40 degrees F or greater for at least 24 hours after installation.

### **3.3 EXTERIOR CEMENT BOARD**

Exterior cement board shall be attached to metal studs with self-tapping wafer-head, corrosion resistant screws, nailed to wood studs, or secured to concrete or masonry with approved fasteners. Screws and nails for application of the board shall be spaced not more than 8 inches on each supporting member, and fasteners into concrete or masonry shall be spaced not more than 12 inches apart horizontally and vertically. Fasteners shall be more closely spaced when required for negative wind load resistance. Edges and ends of boards shall be butted snugly with vertical joints staggered to provide full and even support for the insulation.

### **3.4 INSULATION BOARD AND REINFORCING FABRIC**

Unless otherwise specified by the system manufacturer, insulation boards shall be placed horizontally from a level base line. Vertical joints shall be staggered and insulation boards interlocked at corners. Joints of insulation shall be butted tightly. Surfaces of adjacent insulation boards shall be flush at joints. Joints of insulation shall be offset from substrate joints. Reinforcing glass fabric shall be installed in accordance with the manufacturer's instructions.

### **3.5 ADHESIVE SYSTEM**

Primer (if required by the manufacturer) and adhesive shall be prepared and applied with a stainless steel trowel to substrate in accordance with the manufacturer's instructions. The pattern of the reinforcing fabric shall not be visible. Adhesive used with Class PM must be supplemented with mechanical fasteners. Adhesive shall be used without fasteners only with Class PB system and when recommended by the manufacturer.

### **3.6 BASE COAT**

Base coat shall be mixed in accordance with the manufacturer's instructions and applied to insulated wall surfaces, trowelling the material into the reinforcing fabric in a tight coat and doubling back to provide complete coverage of the reinforcing fabric, panel joints and fasteners. Base coat may be used to level out surface areas when permitted by the manufacturer.

### **3.7 FINISH COATING**

Finish coating shall be applied and leveled in one operation. Final texture shall be obtained by trowels, floats, or by spray application as necessary to achieve the required finish. Finish surfaces shall be plane, with no deviation greater than 1/4 inch when tested with a 10 foot straightedge.

### **3.8 SEALANT**

Edges of the exterior insulation and finish system shall be sealed at openings as recommended by the system manufacturer.

--End of Section--

## SECTION 07270

### FIRESTOPPING

#### **PART I. GENERAL**

##### **1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

##### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 84 (1994) Surface Burning Characteristics of Building Materials

ASTM E 814 (1994b) Fire Tests of Through-Penetration Fire Stops

##### UNDERWRITERS LABORATORIES (UL)

UL-05 (1994; Supple) Fire Resistance Directory

UL 723 (1993; Rev Apr 1994) Test for Surface Burning Characteristics of Building Materials

UL 1479 (1994) Fire Tests of Through-Penetration Firestops

##### **1.2 GENERAL REQUIREMENTS**

Firestopping shall consist of furnishing and installing a material or a combination of materials to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint.

##### **1.3 STORAGE AND DELIVERY**

Materials shall be delivered in the original unopened packages or containers showing name of the manufacturer and the brand name. Materials shall be stored off the ground and shall be protected from damage and exposure to elements. Damaged or deteriorated materials shall be removed from the site.

##### **1.4 INSPECTION**

A representative of the manufacturer shall be on the site during the initial firestopping applications and periodically during the application period to ensure that preparations are adequate, that surfaces are clean and suitable for application, and that materials are applied according to the manufacturer's recommendations and the contract requirements.

##### **1.5 INSTALLER QUALIFICATIONS**

Each installer of firestopping material shall be trained and have a minimum of 3 years experience in the installation of firestopping of the type specified.

## **PART 2 PRODUCTS**

### **2.1 FIRESTOPPING MATERIALS**

Firestopping materials shall consist of commercially manufactured products complying with the following minimum requirements:

#### **2.1.1 Fire Hazard Classification**

Material shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with ASTM E 84 or UL 723. Material shall be an approved firestopping material as listed in UL-05.

#### **2.1.2 Toxicity**

Material shall be nontoxic to humans at all stages of application.

#### **2.1.3 Fire Resistance Rating**

Firestopping will not be required to have a greater fire resistance rating than that of the assembly in which it is being placed.

##### **2.1.3.1 Through-Penetrations**

Firestopping materials for through-penetrations, as described in paragraph GENERAL REQUIREMENTS, shall provide "F" and "T" fire resistance ratings in accordance with ASTM E 814 or UL 1479, except that T Ratings are not required for penetrations smaller than or equal to a 4 inch nominal pipe or 16 square inches in overall cross sectional area. Fire resistance ratings shall be the following:

- a. Penetrations of Fire Resistance Rated Walls and Partitions: F Rating = 1 hour, T Rating = 1 hour.
- b. Penetrations of Fire Resistance Rated Floors and Ceiling-Floor Assemblies; F Rating = 1 hour, T Rating = 1 hour.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

Areas to receive firestopping shall be free of dirt, grease, oil, or loose materials which may affect the fitting or fire resistance of the firestopping system.

### **3.2 INSTALLATION**

Firestopping material shall completely fill void spaces regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping for filling floor voids 4 inches or more in any direction shall be capable of supporting the same load as the floor is designed to support or shall be protected by a permanent barrier to prevent loading or traffic in the firestopped area. Firestopping shall be installed in accordance with manufacturer's written instructions. Firestopping shall be provided in the following locations, except in floor slabs on grade:

- a. Penetrations of duct, conduit, tubing, cable and pipe through floors and through fire-resistance rated walls, partitions, and ceiling-floor assemblies.



- b. Penetrations of vertical shafts such as pipe chases,
- c. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.
- e. Construction joints in floors and fire rated walls and partitions.
- f. Other locations where required to maintain fire resistance rating of the construction.

### **3.3 INSPECTION**

Firestopped areas shall not be covered or enclosed until inspection is complete and approved. A manufacturer's representative shall inspect the applications initially and periodically during the work to assure that the completed work has been accomplished according to the manufacturer's written instructions and the specified requirements.

--End of Section--

## SECTION 07920

### JOINT SEALING

#### **PART I. GENERAL**

##### **1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

##### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 509	(1994) Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C 570	(1994) Oil- and Resin-Base Caulking Compound for Building Construction
ASTM C 734	(1993) Low-Temperature Flexibility of Latex Sealants After Artificial Weathering
ASTM C 834	(1991) Latex Sealants
ASTM C 920	(1987) Elastomeric Joint Sealants
ASTM C 1085	(1991) Butyl Rubber-Based Solvent-Release Sealants
ASTM C 1184	(1991) Structural Silicone-Sealants
ASTM D 217	(1994) Cone Penetration of Lubricating Grease
ASTM D 1056	(1991) Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1565	(1981; R 1990) Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Open-Cell Foam)
ASTM E 84	(1995) Surface Burning Characteristics of Building

##### **1.2 ENVIRONMENTAL REQUIREMENTS**

The ambient temperature shall be within the limits of 40 to 90 degrees F when the sealants are applied.

##### **1.3 DELIVERY AND STORAGE**

Materials shall be delivered to the job in the manufacturer's original unopened containers. The container label or accompanying data sheet shall include the following information as applicable: manufacturer, name of material, formula or specification number, lot number, color, date of manufacture, mixing instructions, shelf life, and curing time at the standard conditions for laboratory tests. Materials shall be handled and stored to prevent inclusion of foreign materials. Materials shall be stored at temperatures between 40 and 90 degrees F unless otherwise specified by the manufacturer.

## **PART 2 PRODUCTS**

### **2.1 BACKING**

Backing shall be 25 to 33 percent oversize for closed cell and 40 to 50 percent oversize for open cell material, unless otherwise indicated.

#### **2.1.1 Rubber Backing**

Cellular rubber sponge backing shall be ASTM D 1056, Type 2, closed cell, Class A, round cross section.

### **2.2 BOND-BREAKER**

Bond-breaker shall be as recommended by the sealant manufacturer to prevent adhesion of the sealant to backing or to bottom of the joint.

### **2.3 PRIMER**

Primer shall be non-staining type as recommended by sealant manufacturer for the application.

### **2.4 CAULKING**

Caulking compounds conforming to ASTM C 570 Type 1 shall be used on interior applications for caulking joints in wood or masonry, or in narrow joints between masonry surfaces, wood surfaces, or metal surfaces where limited movement is anticipated. The listing below indicated the type of applications appropriate for use of oil-and resin-base caulking.

- a. Openings 1/4 inch and less between walls and partitions and adjacent, built-in or surface-mounted equipment and fixtures, etc.
- b. Perimeters of frames of doors, windows, and access panels.
- c. Joints between metal edge members for acoustical board and adjoining vertical surfaces.
- d. Other interior locations where small voids between materials require filling for first-class workmanship and painting.

### **2.5 ELASTOMERIC SEALANTS**

Sealant shall conform to ASTM C 920, Type S and M; Grades NS and P; Class 12.5; uses T, NT and M and shall be used on exterior applications for sealing control joints and other movable joints in concrete, EIFS, and metal where cyclic movement is anticipated. The following listing indicates the types of applications appropriate for use of sealing compounds.

- a. Joints and recesses formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Use sealing compound at exterior surfaces of exterior wall penetrations.
- b. Control joints.
- c. Openings where items pass through exterior walls.

d. Metal-to-metal joints where sealing or caulking is shown or specified.

e. Bottoms of exterior doorway frames.

## **2.6 SOLVENTS AND CLEANING AGENTS**

Solvents, cleaning agents, and accessory materials shall be provided as recommended by the manufacturer.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

#### **3.1.1 Surface Preparation**

The surfaces of joints to be sealed shall be dry. Oil, grease, dirt, chalk, particles of mortar, dust, loose rust, loose mill scale, and other foreign substances shall be removed from surfaces of joints to be in contact with the sealant. Oil and grease shall be removed with solvent and surfaces shall be wiped dry with clean cloths.

#### **3.1.2 Concrete and Surfaces**

Where surfaces have been treated with curing compounds, oil, or other such materials, the materials shall be removed by sandblasting or wire brushing.

#### **3.1.3 Steel Surfaces**

Steel surfaces to be in contact with sealant shall be sandblasted or, if sandblasting would not be practical or would damage adjacent finish work, the metal shall be scraped and wire brushed to remove loose mill scale. Protective coatings on steel surfaces shall be removed by sandblasting or by a solvent that leaves no residue.

#### **3.1.4 Aluminum Surfaces**

Aluminum surfaces to be in contact with sealants shall be cleaned of temporary protective coatings. When masking tape is used for a protective cover, the tape and any residual adhesive shall be removed just prior to applying the sealant. Solvents used to remove protective coating shall be as recommended by the manufacturer of the aluminum work and shall be non-staining.

### **3.2 APPLICATION**

#### **3.2.1 Masking Tape**

Masking tape shall be placed on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or sealant smears. Masking tape shall be removed within 10 minutes after joint has been filled and tooled.

#### **3.2.2 Backing**

Backing shall be installed to provide the indicated sealant depth. The installation tool shall be shaped to avoid puncturing the backing.

#### **3.2.3 Bond-Breaker**

Bond-breaker shall be applied to fully cover the bottom of the joint without contaminating the sides where sealant adhesion is required.

#### **3.2.4 Primer**

Primer shall be used on concrete masonry units, wood, or other porous surfaces in accordance with instructions furnished with the sealant. Primer shall be applied to the joint surfaces to be sealed. Surfaces adjacent to joints shall not be primed.

#### **3.2.5 Sealant**

Sealant shall be used before expiration of shelf life. Multi-component sealants shall be mixed according to manufacturer's printed instructions. Sealant in guns shall be applied with a nozzle of proper size to fit the width of joint. Joints shall be sealed as detailed in the drawings. Sealant shall be forced into joints with sufficient pressure to expel air and fill the groove solidly. Sealant shall be installed to the indicated depth without displacing the backing. Unless otherwise indicated, specified, or recommended by the manufacturer, the installed sealant shall be tooled so that the surface is uniformly smooth and free of wrinkles and to assure full adhesion to the sides of the joint. Sealants shall be installed free of air pockets, foreign embedded matter, ridges and sags. Sealer shall be applied over the sealant when and as specified by the sealant manufacturer.

#### **3.3 CLEANING**

The surfaces adjoining the sealed joints shall be cleaned of smears and other soiling resulting from the sealant application as work progresses.

--End of Section--

## SECTION 08110

### STEEL DOORS AND FRAMES

#### **PART I. GENERAL**

##### **1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

##### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- |             |  |
|-------------|--|
| ASTM D 2863 | (1991) Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)   |
| ASTM E 152  | (1981a) Fire Tests of Door Assemblies  |
| ASTM E 283  | (1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen |

##### DOOR AND HARDWARE INSTITUTE (DHI)

- |             |  |
|-------------|--|
| DHI-A115.IG | (1994) Installation Guide for Doors and Hardware |
|-------------|--|

##### NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- |          |   |
|----------|---|
| NFPA 80  | (1992) Fire Doors and Windows                               |
| NFPA 80A | (1993) Protection of Buildings from Exterior Fire Exposures |
| NFPA 101 | (1994) Safety to Life from Fire in Buildings and Structures |

##### STEEL DOOR INSTITUTE (SDOI)

- |              |  |
|--------------|--|
| SDOI SDI-100 | (1991) Standard Steel Doors and Frames                       |
| SDOI SDI-106 | (1991) Standard Door Type Nomenclature                       |
| SDOI SDI-107 | (1984) Hardware on Steel Doors (Reinforcement - Application) |

##### **1.2 DELIVERY AND STORAGE**

During shipment, welded unit type frames shall be provided with temporary steel spreaders at the bottom of each frame. Materials shall be delivered to the site in undamaged condition, and stored out of contact with the ground and under a weathertight covering permitting air circulation. Doors and assembled frames shall be stored in an upright position in accordance with DHI-A115.IG. Abraded, scarred, or rusty areas shall be cleaned and touched up with matching finishes.

### **1.3 WARRANTY**

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

## **PART 2 PRODUCTS**

### **2.1 DOORS AND FRAMES**

Doors and frames shall be factory fabricated in accordance with SDOI SDI-100 and the additional requirements specified herein. Door grade shall be heavy duty (Grade II) unless otherwise indicated on the door and door frame schedules. Exterior doors and frames shall be designation G60. Doors and frames shall be prepared to receive hardware conforming to the templates and information provided under Section 08700 BUILDERS' HARDWARE. Doors and frames shall be reinforced, drilled, and tapped to receive mortised hinges, locks, latches, and flush bolts as required. Doors and frames shall be reinforced for surface applied hardware. Frames shall be welded type located. Door frames shall be furnished with a minimum of three jamb anchors and one floor anchor per jamb. Anchors shall be not less than 18 gauge steel or 7 gauge diameter wire. For wall conditions that do not allow the use of a floor anchor, an additional jamb anchor shall be provided. Rubber silencers shall be furnished for installation into factory predrilled holes in door frames; adhesively applied silencers are not acceptable. Where frames are installed in plaster or masonry walls, plaster guards shall be provided on door frames at hinges and strikes. Reinforcing of door assemblies for closers and other required hardware shall be in accordance with SDOI SDI-100 and the conditions of the fire door assembly listing when applicable. Exterior doors shall have top and bottom edges closed flush and sealed against water penetration.

### **2.2 FIRE RATED DOORS**

Fire rated door assemblies shall bear the listing identification label of a nationally recognized testing laboratory qualified to perform tests of fire door assemblies in accordance with ASTM E 152 and having a listing for the tested assemblies. The fire resistance rating shall be required by code. Listing identification labels shall be constructed and permanently applied by a method which results in their destruction should they be removed.

### **2.3 THERMAL INSULATED DOORS**

The interior of thermal insulated doors shall be completely filled with rigid plastic foam permanently bonded to each face panel. The thermal conductance (U-value) through the door shall not exceed 0.41 btu/hr times sq f times f when tested as an operational assembly in accordance with ASTM C 236 or ASTM C 976. Doors with cellular plastic cores shall have a minimum oxygen index rating of 22 percent when tested in accordance with ASTM D 2863.

### **2.4 WEATHERSTRIPPING**

Unless otherwise specified in Section 08700 BUILDERS' HARDWARE, weatherstripping shall be as follows: Weatherstripping for head and jamb shall be manufacturer's standard elastomeric type of synthetic rubber, vinyl, or neoprene and shall be installed at the factory or on the jobsite in accordance with the door frame manufacturer's recommendations. Weatherstripping for bottom of doors shall include an aluminum threshold with vinyl insert and surface applied drip as called for in Section 08700 Builders' Hardware. Air leakage rate of weatherstripping shall not exceed 0.20 cfm per linear foot of crack when tested in accordance with ASTM E 283 at standard test conditions.

## **2.5 FACTORY FINISH**

Doors and frames shall be phosphatized , primed, and finished with an electrostatic baked on enamel or polyester base factory finish paint system. Color shall be in accordance with Section 09915 COLOR SCHEDULE.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

Installation shall be in accordance with DHI-A115.IG. Preparation for surface applied hardware shall be in accordance with SDOI SDI-107. Rubber silencers shall be installed in door frames after finish painting has been completed; adhesively applied silencers are not acceptable. Weatherstripping shall be installed at exterior door openings to provide a weathertight installation. Installation and operational characteristics of fire doors shall be in accordance with NFPA 80, NFPA 80A and NFPA 101. Hollow metal door frames shall be solid grouted in solid steel stud walls.

#### **3.1.1 Thermal Insulated Doors**

Hardware and perimeter seals shall be adjusted for proper operation. Doors shall be sealed weathertight after installation of hardware and shall be in accordance with Section 07920 JOINT SEALING.

--End of Section--



## SECTION 08201

### WOOD DOORS

#### **PART I. GENERAL**

##### **1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 152 (1981a) Fire Tests of Door Assemblies

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (1992) Fire Doors and Windows

NFPA 101 (1994) Safety to Life from Fire in Buildings and Structures

NATIONAL WOOD WINDOW & DOOR ASSOCIATION (NWWDA)

NWWDA I.S. 1-A (1993) Architectural Wood Flush Doors

NWWDA I.S. 4 (1994) Water-Repellent Preservative Non-Pressure Treatment for Millwork

##### **1.2 GENERAL REQUIREMENTS**

###### **1.2.1 Standard Products**

Doors shall be of the type, size, and design indicated on the drawings, and shall be the standard products of manufacturers regularly engaged in the manufacture of wood doors.

###### **1.2.2 Marking**

Each door shall bear a stamp, brand, or other identifying mark indicating quality and construction of the door. The identifying mark or a separate certification shall include identification of the standard on which construction of the door is based, identity of the manufacturing plant, identification of the standard under which preservative treatment, if used, was made, and identification of the doors having a Type I glue bond.

##### **1.3 STORAGE**

Doors shall be stored in fully covered areas and protected from damage and from extremes in temperature and humidity. Doors shall be stored on supports to prevent warping or twisting, and to provide ventilation. Factory cartons or wrappers shall be kept intact until installation.

##### **1.4 HARDWARE**

Hardware, including weatherstripping and thresholds, is specified in Section 08700 BUILDERS' HARDWARE.

## **1.5 WARRANTY**

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

## **PART 2 PRODUCTS**

### **2.1 GENERAL FABRICATION REQUIREMENTS**

#### **2.1.1 Edge Sealing**

Wood end-grain exposed at edges of doors shall be sealed prior to shipment.

#### **2.1.2 Adhesives**

Adhesives shall be in accordance with NWWDA I.S. 1-A, requirements for Type II Bond Doors (water-repellent) for interior doors.

#### **2.1.3 Prefitting**

Doors shall be furnished prefitted or unfitted at the option of the Contractor.

### **2.2 FLUSH DOORS**

Flush doors shall be solid core and shall conform to NWWDA I.S. 1-A, except for the one year acclimation requirement in paragraph T-2, which shall not apply. Wood doors shall be 5-ply or 7-ply construction with faces, stiles, and rails bonded to the cores.

#### **2.2.1 Core Construction**

##### **2.2.1.1 Solid Cores**

Door construction shall be glued wood block core or particle board core with vertical and horizontal edges bonded to the core. Blocking and hardware reinforcements for particle board and mineral core doors shall be blocking option HB-1-5 in accordance with NWWDA I.S. 1-A.

#### **2.2.2 Face Panels**

##### **2.2.2.1 Painted Wood Veneer Doors**

Veneer doors to receive paint finish shall be Economy Grade with medium density overlay in accordance with NWWDA I.S. 1-A. Door finish shall be in accordance with paragraph FIELD FINISHING.

### **2.3 FIRE RATED DOORS**

Fire rated door assemblies shall bear the listing identification label of a nationally recognized testing laboratory qualified to perform tests of fire door assemblies in accordance with ASTM E 152 and having a listing for the tested assemblies. The specific time interval rating on the labels shall be as required. Door assemblies shall be in accordance with NFPA 80. Listing identification on labels shall be constructed and permanently applied by a method which results in their destruction should they be removed. Fire rated doors shall be particleboard core minute rating.

### **2.3.1 Reinforcement Blocking**

Fire rated doors shall be provided, as required, with hardware reinforcement blocking, and top, bottom, and intermediate rail blocking. Lock blocks shall be manufacturer's standard 5 inches by 18 inches. Reinforcement blocking shall be in compliance with the manufacturer's labeling requirements. Reinforcement blocking shall not be of mineral material.

### **2.3.2 Stile Edges**

Composite fire rated doors shall be provided with vertical stile edges that do not contain fire retardant salts. Vertical stiles shall be of the same species and/or color as the face veneer.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION OF DOORS**

#### **3.1.1 General Use Doors**

Doors shall be fit, hung, and trimmed as required. Door shall have a clearance of 1/8 inch at the sides and top and shall have a bottom clearance of 1/4 inch over thresholds and 1/2 inch at other locations unless otherwise shown. The lock edge or both edges of doors shall be beveled at the rate of 1/8 inch in 2 inches. Cuts made on the job shall be sealed immediately after cutting, using a clear varnish or sealer. Bottom of doors shall be undercut to allow clear door swing over carpeted areas. Vertical edges of doors which have not been rounded or beveled at the factory shall be eased when the doors are installed.

#### **3.1.2 Fire Doors**

Installation, hardware, and operational characteristics shall conform to NFPA 80 and NFPA 101 and shall be in strict conformance with the manufacturer's printed instructions. Properly sized pilot holes shall be drilled for screws in door edges. Factory applied labels shall remain intact where installed. Labeled hinge stile edge and top edge of door shall not be trimmed. Lockstile edge and bottom edge may be trimmed only to the extent recommended by the door manufacturer.

### **3.2 FIELD FINISHING**

Doors to receive field finishing, whether paint or natural finish, shall be factory primed or sealed, as required, and then shall be finished in accordance with Section 09900 PAINTING, GENERAL. Factory applied sealer shall not prevent doors from accepting field finish. Color shall be in accordance with Section 09915 COLOR SCHEDULE. Field touch-up of factory finishes shall be in accordance with manufacturers instructions.

--End of Section--

SECTION 08520  
ALUMINUM WINDOWS

**PART I. GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

- |            |  |
|------------|--|
| AAMA 101   | (1993) Voluntary Specifications for Aluminum Prime Windows and Sliding Glass Doors   |
| AAMA 605.2 | (1992; Addenda Feb 1994) Voluntary Specification for High Performance Organic Coatings on Architectural Aluminum Extrusions and Panels |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- |            |  |
|------------|--|
| ASTM E 283 | (1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen |
| ASTM E 330 | (1990) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference                                  |
| ASTM E 547 | (1986) Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential                                      |

FEDERAL SPECIFICATIONS (FS)

- |             |  |
|-------------|--|
| FS RR-W-365 | (Rev A) Wire Fabric (Insect Screening) |
|-------------|--|

SCREEN MANUFACTURERS ASSOCIATION (SMA)

- |          |   |
|----------|---|
| SMA 1004 | (1987) Aluminum Tubular Frame Screens for Windows |
|----------|---|

**1.2 WINDOW PERFORMANCE**

Aluminum windows shall be designed to meet the following performance requirements. Testing requirements shall be performed by an independent testing laboratory or agency.

**1.2.1 Structural Performance**

Structural test pressures on window units shall be for positive load (inward) and negative load (outward) in accordance with ASTM E 330. After testing, there shall be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms or any other damage which could cause window to be inoperable. There shall be no permanent deformation of any main frame, sash or ventilator member in excess of the requirements established by AAMA 101 for the window types and classification specified in this section.

### **1.2.2 Air Infiltration**

Air infiltration shall not exceed the amount established by AAMA 101 for each window type when tested in accordance with ASTM E 283.

### **1.2.3 Water Penetration**

Water penetration shall not exceed the amount established by AAMA 101 for each window type when tested in accordance with ASTM E 547.

## **1.3 QUALIFICATION**

Window manufacturer shall specialize in designing and manufacturing the type of aluminum windows specified in this section, and shall have a minimum of FIVE years of documented successful experience. Manufacturer shall have the facilities capable of meeting contract requirements, single-source responsibility and warranty.

## **1.4 DELIVERY AND STORAGE**

Aluminum windows shall be delivered to project site and stored in accordance with manufacturer's recommendations. Damaged windows shall be replaced with new windows.

## **1.5 WARRANTY**

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

# **PART 2 PRODUCTS**

## **2.1 ALUMINUM WINDOW TYPES**

Aluminum windows shall consist of complete units including sash, glass, frame, weatherstripping, snap-in muntins, and hardware. Windows shall conform to AAMA 101. Windows shall be double-glazed double-glazed. Operable windows shall permit cleaning the outside glass from inside the building.

### **2.1.1 Double-Hung Windows**

Aluminum double-hung windows shall conform to AAMA 101 DH-C30 type which operate vertically with the weight of sash offset by a counterbalancing mechanism mounted in window to hold the sash stationary at any open position. Double-hung windows shall be provided with locking devices to secure the sash in the closed position. Counterbalancing mechanisms shall be easily replaced after installation.

## **2.2 WEATHERSTRIPPING**

Weatherstripping for ventilating sections shall be of type designed to meet water penetration and air infiltration requirements specified in this section in accordance with AAMA 101, and shall be manufactured of material compatible with aluminum and resistant to weather. Weatherstrips shall be factory-applied and easily replaced in the field. Neoprene or polyvinylchloride weatherstripping are not acceptable where exposed to direct sunlight.

## **2.3 INSECT SCREENS**

Insect screens shall be aluminum window manufacturer's standard design, and shall be provided at all windows. Insect screens shall be fabricated of roll-formed tubular-shaped stainless steel frames conforming to SMA 1004 and (18 x 16) stainless steel mesh screening conforming with FS RR-W-365, Type IV.

## **2.4 ACCESSORIES**

### **2.4.1 Fasteners**

Fastening devices shall be window manufacturer's standard design made from aluminum, non-magnetic stainless steel, cadmium-plated steel, nickel/chrome-plated steel or magnetic stainless steel in compliance with AAMA 101. Self-tapping sheet metal screws will not be acceptable for material thicker than 1/16 inch.

### **2.4.2 Hardware**

Hardware shall be as specified for each window type and shall be fabricated of aluminum, stainless steel, cadmium-plated steel, zinc-plated steel or nickel/chrome-plated steel of quality established by AAMA 101.

### **2.4.3 Window Anchors**

Anchoring devices for installing windows shall be made of aluminum, cadmium-plated steel, stainless steel, or zinc-plated steel conforming to AAMA 101.

## **2.5 GLASS AND GLAZING**

Aluminum windows shall be designed for inside glazing, field glazing, and for glass types scheduled on drawings and specified in Section 08810 GLASS AND GLAZING. Units shall be complete with glass and glazing provisions to meet AAMA 101. Glazing material shall be compatible with aluminum, and shall not require painting.

## **2.6 FINISH**

### **2.6.1 High-Performance Coating**

Exposed surfaces of aluminum windows shall be finished with a two-coat fluoropolymer coating system containing at least 70 percent by weight polyvinylidene fluoride, PVF2 resin, factory-applied, oven-baked, conforming to AAMA 605.2, with a primer coat of 0/20 to 0.30 mils and a color coat of minimum 1.0 mils, total dry film thickness of 1.20 to 1.3 mils. Finish shall be free of scratches and other blemishes.

### **2.6.2 Color**

Color shall be in accordance with Section 09915 COLOR SCHEDULE.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

Aluminum windows shall be installed in accordance with approved shop drawings and manufacturer's published instructions. Aluminum surfaces in contact with masonry, concrete, wood and dissimilar metals other than stainless steel, zinc, cadmium or small areas of white bronze, shall be protected from direct

contact using protective materials recommended by AAMA 101. The completed window installation shall be watertight in accordance with Section 07920 JOINT SEALING. Glass and glazing shall be installed in accordance with requirements of this section and Section 08810 GLASS AND GLAZING.

### **3.2 ADJUSTMENTS AND CLEANING**

#### **3.2.1 Hardware Adjustments**

Final operating adjustments shall be made after glazing work is complete. Operating sash or ventilators shall operate smoothly and shall be weathertight when in locked position.

#### **3.2.2 Cleaning**

Aluminum window finish and glass shall be cleaned on exterior and interior sides in accordance with window manufacturer's recommendations. Alkaline or abrasive agents shall not be used. Precautions shall be taken to avoid scratching or marring window finish and glass surfaces.

--End of Section--

## SECTION 08700

### BUILDERS' HARDWARE

#### PART I. GENERAL

##### 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

##### BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A156.1	(1988) Butts and Hinges
BHMA A156.2	(1989) Bored and Preassembled Locks and Latches
BHMA A156.5	(1992) Auxiliary Locks & Associated Products
BHMA A156.6	(1994) Architectural Door Trim
BHMA A156.7	(1988) Template Hinge Dimensions
BHMA A156.13	(1994) Mortise Locks & Latches
BHMA A156.16	(1989) Auxiliary Hardware
BHMA A156.17	(1993) Self Closing Hinges & Pivots
BHMA A156.18	(1993) Materials and Finishes
BHMA A156.21	(1989) Thresholds

##### DOOR AND HARDWARE INSTITUTE (DHI)

DHI-03	(1989) Keying Systems and Nomenclature
DHI-04	(1976) Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames
DHI-05	(1990) Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames
DHI-A115.IG	(1994) Installation Guide for Doors and Hardware
DHI A115-W	(Varies) Wood Door Hardware Standards (Incl A115-W1 thru A115-W9)

##### NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(1995) Fire Doors and Windows
NFPA 101	(1994) Safety to Life from Fire in Buildings and Structures

##### 1.2 PREDELIVERY CONFERENCE

Upon approval of the Hardware Schedule, the construction Contractor shall arrange a conference with the hardware supplier, Contracting Officer and the using agency to determine keying system requirements. Location of the key



control storage system, set-up and key identification labeling will also be determined.

## **1.2 DELIVERY, STORAGE, AND HANDLING**

Hardware shall be delivered to the project site in the manufacturer's original packages. Each article of hardware shall be individually packaged in the manufacturer's standard commercial carton or container, and shall be properly marked or labeled to be readily identifiable with the approved hardware schedule. Each change key shall be tagged or otherwise identified with the door for which its cylinder is intended. Where double cylinder functions are used or where it is not obvious which is the key side of a door, appropriate instructions shall be included with the lock and on the hardware schedule. Manufacturer's printed installation instructions, fasteners, and special tools shall be included in each package.

## **1.3 SPECIAL TOOLS**

Special tools, such as those supplied by the manufacturer, unique wrenches, and dogging keys, shall be provided as required to adjust hardware items.

## **1.4 WARRANTY**

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

# **PART 2 PRODUCTS**

## **2.1 GENERAL HARDWARE REQUIREMENTS**

Hardware shall conform to the requirements specified herein and the HARDWARE SETS listing at the end of this section. Hardware set numbers correspond to the set numbers shown on the drawings.

## **2.2 TEMPLATES**

Requirements for hardware to be mounted on metal doors or metal frames shall be coordinated between hardware manufacturer and door or frame manufacturer by use of templates and other information to establish location, reinforcement required, size of holes, and similar details. Templates of hinges shall conform to BHMA A156.7.

## **2.3 HINGES**

Hinges shall conform to BHMA A156.1. Hinges used on metal doors and frames shall also conform to BHMA A156.7. Except as otherwise specified, hinge sizes shall conform to the hinge manufacturer's printed recommendations.

### **2.3.1 Hinges for Reverse Bevel Doors with Locks**

Hinges for reverse bevel doors with locks shall have pins that are made nonremovable by means such as a set screw in the barrel, or safety stud, when the door is in the closed position.

### **2.3.2 Contractor's Option**

Hinges with antifriction bearings may be furnished in lieu of ball bearing hinges, except where prohibited for fire doors by the requirements of NFPA 80.

### **2.3.3 Spring Hinges**

Spring hinges shall conform to BHMA A156.17.

## **2.4 LOCKS AND LATCHES**

To the maximum extent possible, locksets, latchsets and deadlocks shall be the products of a single manufacturer. Lock fronts for double-acting doors shall be rounded. Strikes for wood frames and pairs of wood doors shall be furnished with wrought boxes.

### **2.4.1 Mortise Lock and Latchsets**

Mortise lock, latchsets, and strikes shall be series 1000 and shall conform to BHMA A156.13, operational Grade 1. Mortise type locks and latches for doors 1-3/4 inches thick and over shall have adjustable bevel fronts or otherwise conform to the shape of the door. Mortise locks shall have armored fronts.

### **2.4.2 Bored Lock and Latchsets**

Bored lock, latchsets, and strikes shall be series 4000 and shall conform to BHMA A156.2, Grade 1. Bored type locks and latches for doors 1-3/8 inches thick and over shall have adjustable bevel fronts or otherwise conform to the shape of the door.

### **2.4.3 Auxiliary Locks and Associated Products**

Bored and mortise dead locks and dead latches, and dead bolts, conform to BHMA A156.5. Bolt and latch retraction shall be dead bolt style. Strike boxes shall be furnished with dead bolt and latch strikes for Grade 1.

### **2.4.4 Lock Cylinders (Mortise, Rim and Bored)**

Lock cylinders shall comply with BHMA A156.5. Lock cylinder shall have not less than seven pins. Cylinders shall have key removable type cores. A grand master keying system shall be provided. Disassembly of knob or lockset shall not be required to remove core from lockset.

### **2.4.5 Lock Trim**

Lock trim shall be cast, forged, or heavy wrought construction of commercial plain design. In addition to meeting the test requirement of BHMA A156.2 or BHMA A156.13, knobs, lever handles, roses, and escutcheons shall be 0.050 inch thick, if unreinforced. If reinforced, the outer shell shall be 0.035 inch thick and the combined thickness shall be 0.070 inch except that knob shanks shall be 0.060 inch thick. Knob diameter shall be 2-1/8 to 2-1/4 inches. Lever handles shall be of plain design with ends returned to no more than 1/2 inch from the door face.

## **2.5 KEYING**

Locks shall be keyed in sets or subsets as scheduled. Change keys for locks shall be stamped with change number and the inscription "U.S. Property - Do Not Duplicate." Keys shall be supplied as follows:

Locks:	3 change keys each lock.
Master keyed sets:	3 keys each set.
Grand master keys:	4 total.
Blank keys:	60 total.

The keys shall be furnished to the Contracting Officer arranged for key control system storage in sets or subsets as scheduled.

## **2.6 ARCHITECTURAL DOOR TRIM**

Architectural door trim shall conform to BHMA A156.6.

### **2.6.1 Door Protection Plates**

#### **2.6.1.1 Kick Plates**

Kick plates shall be Type aluminum. Width of plates shall be 2 inches less than door width for single doors and 1 inch less for pairs of doors. Height shall be 10 inches. Edges of metal plates shall be beveled.

#### **2.6.1.2 Mop Plates**

Mop plates shall be Type J103 aluminum. Width of plates shall be 2 inches. The height shall be 4 inches. Edges of metal plates shall be beveled.

## **2.7 AUXILIARY HARDWARE**

Auxiliary hardware, consisting of apartment knockers door holders, door stops and roller latches, shall conform to BHMA A156.16.

## **2.8 MISCELLANEOUS**

### **2.8.1 Metal Thresholds**

Thresholds shall conform to BHMA A156.21. Thresholds for exterior doors shall be extruded aluminum of the type indicated and shall provide proper clearance and an effective seal with specified weather stripping. Air leakage rate of weatherstripping shall not exceed 0.20 cubic feet per minute per lineal foot of crack when tested in accordance with ASTM E 283 at standard test conditions.

#### **2.8.2 Rain Drips**

Extruded aluminum, not less than 0.07 inch thick, painted. Door sill rain drips shall be 1-1/2 inches to 1-3/4 inches high by 5/8 inch projection.

#### **2.8.3 Gasketing**

Gasketing shall be a compression type seal, silicon based, self-adhesive product for use on steel door frames with wood doors for 20-minute. Color shall be white bronze. Air leakage rate of weatherstripping shall not exceed 0.5 cubic feet per minute per lineal foot of crack when tested in accordance with ASTM E 283 at standard test conditions.

#### **2.8.4 Key Control Storage System**

Key control storage system shall conform to BHMA A156.5, Type E.8351, capacity 100, and shall be properly labeled for key identification. Set up, identification labeling and location of the key control storage shall be as directed at the Predelivery Conference.

## **2.9 FASTENINGS**

Fastenings of proper type, size, quantity, and finish shall be supplied with each article of hardware. Machine screws and expansion shields shall be used for attaching hardware to concrete or masonry. Fastenings exposed to the weather in the finished work shall be of brass, bronze, or stainless steel. Sex bolts, through bolts, or machine screws and grommet nuts, where used on reverse-bevel exterior doors equipped with half-surface or full-surface

hinges, shall employ one-way screws or other approved tamperproof screws. Screws for the jamb leaf of half-mortise and full-surface hinges attached to structural steel frames shall be one-way or other approved tamperproof type.

## **2.10 FINISHES**

Unless otherwise specified, finishes shall conform to those identified in BHMA A156.18. Where painting of primed surfaces is required, painting is specified in Section 09900 PAINTING, GENERAL.

## **2.11 HARDWARE FOR FIRE DOORS**

Hardware for fire doors shall conform to the requirements of NFPA 80 and NFPA 101.

# **PART 3 EXECUTION**

## **3.1 APPLICATION**

Hardware shall be located in accordance with DHI-04 and DHI-05. When approved, slight variations in locations or dimensions will be permitted. Application shall be in accordance with DHI-A115.IG or DHI A115-W. Door control devices for exterior doors such as closers and holders, shall be attached to doors with thru bolts and nuts or sex bolts. Alternate fastening methods may be approved by the Contracting Officer when manufacturers' documentation is submitted to verify that the fastening devices and door reinforcements are adequate to resist wind induced stresses. Electric hardware items and access control devices shall be installed in accordance with manufacturer's printed installation procedures.

### **3.1.1 Hardware for Fire Doors**

Hardware for fire doors shall be installed in accordance with the requirements of NFPA 80. Other hardware installed on fire doors, such as locksets, closers, and hinges shall have a visible label or stamp indicating that the hardware items have been approved by an approved testing agency for installation on fire-rated doors.

### **3.1.2 Key Control Storage Systems**

Key control storage system shall be installed where directed.

### **3.1.3 Kick Plates and Mop Plates**

Kick plates shall be installed on the push side of single-acting exterior doors. Mop plates shall be installed on both of the interior doors.

### **3.1.4 Thresholds**

Thresholds shall be secured with a minimum of three fasteners per single door width and six fasteners per double door width with a maximum spacing of 12 inches. Exterior thresholds shall be installed in a bed of sealant with expansion anchors and stainless steel screws. Minimum screw size shall be No. 10 length, dependent on job conditions, with a minimum of 3/4 inch thread engagement into the floor or anchoring device used.

### **3.1.5 Rain Drips**

Door sill rain drips shall align with the bottom edge of the door. Drips shall be set in sealant and fastened with stainless steel screws.

### 3.1.6 Weatherseals

Weatherseals shall be located as indicated, snug to door face and fastened in place with color matched metal screws after door and frames have been finish painted. Screw spacing shall be as recommended by manufacturer.

### 3.1.7 Gasketing

Gasketing shall be installed at the inside edge of the hinge and head and latch sides of door frame. Frames shall be toleranced for a 1/8 inch clearance between door and frame. Frames shall be treated with tape primer prior to installation.

## 3.2 HARDWARE SETS

### HW-1

1 EA HINGE K21071  
1 PR HINGES A5112  
1 EA LOCKSET F20  
1 EA STOP L02101  
1 EA VIEWER L03171  
1 EA THRESHOLD J11100  
1 EA KICKPLATE  
1 EA DRIP  
1 EA KNOCKER L03161

### HW-2

1-1/2 PR HINGES A8133  
1 EA LATCHSET F75

### HW-3

1 EA HINGE K21071  
1 PR HINGES A8133  
1 EA LOCKSET F88  
1 EA STOP  
2 EA MOP PLATE

### HW-4

1-1/2 PR HINGES A8133  
1 EA LOCKSET F76  
2 EA MOP PLATE

--End of Section--

SECTION 08810  
GLASS AND GLAZING

**PART I. GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 920	(1987) Elastomeric Joint Sealants
ASTM C 1036	(1991) Flat Glass
ASTM D 395	(1989) Rubber Property - Compression Set
ASTM E 773	(1988) Seal Durability of Sealed Insulating Glass Units
ASTM E 774	(1988) Sealed Insulating Glass Units

FEDERAL SPECIFICATIONS (FS)

FS DD-M-411	(Rev C) Mirrors, Glass
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FLAT GLASS MARKETING ASSOCIATION (FGMA)

FGMA-01	(1990) Glazing Manual
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**1.2 SYSTEM DESCRIPTION**

Glazing systems shall be fabricated and installed watertight and airtight to withstand thermal movement and wind loading without glass breakage, gasket failure, deterioration of glazing accessories, and defects in the work.

**1.3 DELIVERY, STORAGE AND HANDLING**

Glazing compounds shall be delivered to the site in the manufacturer's unopened containers. Glass shall be stored indoors in a safe, well ventilated dry location in accordance with manufacturer's instructions, and shall not be unpacked until needed for installation. Glass shall not be stored on site over 1 month.

**1.4 PROJECT/SITE CONDITIONS**

Glazing work shall not be started until outdoor temperature is above 40 degrees F and rising, unless procedures recommended by glass manufacturer and approved by Contracting Officer's representative are made to warm the glass and rabbet surfaces. Ventilation shall be provided to prevent condensation of moisture on glazing work during installation. Glazing work shall not be performed during damp or raining weather.

## **1.5 WARRANTY**

### **1.5.1 Insulating Glass**

Manufacturer shall warrant the insulating glass to be free of fogging or film formation on the internal glass surfaces caused by failure of the hermetic seal for a period of 10 years from Date of Substantial Completion. Warranty shall be signed by manufacturer.

## **PART 2 PRODUCTS**

### **2.1 INSULATING GLASS**

Insulating glass shall be Class A preassembled units of dual-seal construction consisting of lites of glass separated by an aluminum spacer and dehydrated space conforming to ASTM E 773 and ASTM E 774. Aluminum spacer shall be roll-formed, with bent or tightly soldered joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal shall be compressed polyisobutylene and the secondary seal shall be a specially formulated silicone. Glass types shall be as follows:

#### **2.1.1 Low-E Insulating Glass**

Interior and exterior glass panes for Low-E insulating units shall be Type I annealed flat glass, Class 2-tinted with anti-reflective low-emissivity coating on No. 3 surface (inside surface of exterior pane), Quality q3 - glazing select, conforming to ASTM C 1036. Glass performance shall be Summer 3, Value/Winter 0.29, shading coefficient 0.66. Color shall be bronze. Solar heat gain coefficient 0.56.

### **2.2 MIRRORS**

#### **2.2.1 Glass Mirrors**

Glass for mirrors shall be Type I transparent flat type, Class 1-clear Glazing Quality q1 1/4 inch thick conforming to ASTM C 1036. Glass shall be coated with silver coating, copper protective coating, and mirror backing paint conforming to FS DD-M-411. Silver coating shall be highly adhesive pure silver coating of a thickness which shall provide reflectivity of 83 percent or more of incident light when viewed through 1/4 inch thick glass, free of pinholes or other defects. Copper protective coating shall be pure bright reflective copper, homogeneous without sludge, pinholes or other defects, and shall be of proper thickness to prevent "adhesion pull" by mirror backing paint. Mirror backing paint shall consist of two coats of special scratch and abrasion-resistant paint applied, and shall be baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication.

#### **2.2.2 Mirror Accessories**

##### **2.2.2.1 Mastic**

Mastic for setting mirrors shall be a polymer type mirror mastic resistant to water, shock, cracking, vibration and thermal expansion. Mastic shall be compatible with mirror backing paint, and shall be approved by mirror manufacturer.

##### **2.2.2.2 Mirror Clips**

Concealed fasteners of type to suit wall construction material shall be provided with clips.

## **2.3 GLAZING ACCESSORIES**

### **2.3.1 Sealant**

Sealant shall be elastomeric conforming to ASTM C 920, Type S or M, Grade NS, Class 12.5, Use G, of type chemically compatible with setting blocks, preformed sealing tape and sealants used in manufacturing insulating glass. Color of sealant shall be as selected

### **2.3.2 Setting and Edge Blocking**

Neoprene setting blocks shall be dense extruded type conforming to ASTM D 395, Method B, Shore A durometer between 70 and 90. Edge blocking shall be Shore A durometer of 50 (+ or - 5). Silicone setting blocks shall be required when blocks are in contact with silicone sealant. Profiles, lengths and locations shall be as required and recommended in writing by glass manufacturer.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

Openings and framing systems scheduled to receive glass shall be examined for compliance with approved shop drawings, FGMA-01 and glass manufacturer's recommendations including size, squareness, offsets at corners, presence and function of weep system, face and edge clearance requirements and effective sealing between joints of glass-framing members. Detrimental materials shall be removed from glazing rabbet and glass surfaces and wiped dry with solvent. Glazing surfaces shall be dry and free of frost.

### **3.2 INSTALLATION**

Glass and glazing work shall be performed in accordance with approved shop drawings, FGMA-01, glass manufacturer's instructions and warranty requirements. Glass shall be installed with factory labels intact and removed only when instructed.

### **3.3 CLEANING**

Upon completion of project, outside surfaces of glass shall be washed clean and the inside surfaces of glass shall be washed and polished in accordance with glass manufacturer's recommendations.

### **3.4 PROTECTION**

Glass work shall be protected immediately after installation. Glazed openings shall be identified with suitable warning tapes, cloth or paper flags, attached with non-staining adhesives. Protective material shall be placed far enough away from the coated glass to allow air to circulate to reduce heat buildup and moisture accumulation on the glass. Glass units which are broken, chipped, cracked, abraded, or otherwise damaged during construction activities shall be removed and replaced with new units.

--End of Section--



SECTION 09250  
GYPSUM WALLBOARD

**PART I. GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 580	(1991b) Stainless and Heat Resisting Steel Wire
ASTM A 853	(1991) Steel Wire, Carbon, for General Use
ASTM C 36	(1993) Gypsum Wallboard
ASTM C 442	(1992) Gypsum Backing Board and Coreboard
ASTM C 475	(1989) Joint Compound and Joint Tape for Finishing Gypsum Board
ASTM C 665	(1991) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 754	(1988) Installation of Steel Framing Members to Receive Screw-Attached Gypsum
ASTM C 840	(1988) Application and Finishing of Gypsum Board
ASTM C 1002	(1993) Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P8016	(1993) Specification Tested Products Guide
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FEDERAL SPECIFICATIONS (FS)

FS QQ-N-281	(Rev D; Am 2) Nickel-Copper Alloy Bar, Rod, Plate, Sheet, Strip, Wire, Forgings and Structural and Special Shaped Sections
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GYPSUM ASSOCIATION (GA)

GA 600	(1992) Fire Resistance Design Manual
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UNDERWRITERS LABORATORIES (UL)

UL-05	(1993; supple) Fire Resistance Directory
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## **1.2 SYSTEM DESCRIPTION**

### **1.2.1 Fire-Rated Construction**

Joints of fire-rated gypsum board enclosures shall be closed and sealed in accordance with UL requirements, and as required to meet pressurization requirements. Penetrations through rated partitions and ceilings shall be sealed tight with rated firestopping materials. Fire ratings shall be as indicated.

### **1.3 QUALIFICATIONS**

Manufacturer shall specialize in manufacturing the types of material specified and shall have a minimum of 10 years of documented successful experience. Installer shall specialize in the type of gypsum board work required and shall have a minimum of 5 years of documented successful experience.

### **1.4 DELIVERY, STORAGE AND HANDLING**

Materials shall be delivered in original containers bearing the name of manufacturer, contents, and brand name. Materials shall be stored off the ground in a weathertight structure for protection. Gypsum boards shall be stacked flat, off floor and supported to prevent sagging and warpage. Adhesives and joint materials shall be stored in accordance with manufacturer's printed instructions. Damaged or deteriorated materials shall be removed from jobsite.

### **1.5 ENVIRONMENTAL CONDITIONS**

Environmental conditions for application and finishing of gypsum board shall be in accordance with ASTM C 840. During the application of gypsum board without adhesive, a room temperature of not less than 40 degrees F shall be maintained. Building spaces shall be ventilated to remove water not required for drying joint treatment materials. Drafts shall be avoided during dry hot weather to prevent materials from drying too rapidly.

## **PART 2 MATERIALS**

### **2.1 NON-LOADBEARING STUD WALLS**

#### **2.1.1 Studs**

Studs for non-loadbearing walls shall conform to ASTM C 645. Studs shall be prefabricated 25 gauge and 20 gauge steel, C-shaped, punched web for utility access, G60 hot-dip galvanized after fabrication,

#### **2.1.2 Runner Tracks**

Floor and ceiling runner tracks shall conform to ASTM C 645. Tracks shall be prefabricated, U-shaped with minimum 7/8 inch flanges, unpunched web, gauge to match studs, G60 hot-dip galvanized after fabrication.

### **2.2 SUSPENDED CEILING FRAMING**

Main carrying channels and cross furring members for suspended gypsum board ceilings shall conform to ASTM C 645. Carrying channels shall be formed from 16 gauge cold-rolled steel, hot-dipped galvanized after fabrication, 1-1/2 x 3/4 inch deep. Furring members shall be formed from cold-rolled steel, hot-dip galvanized after fabrication, 3/4 inch high x 3/4 inch deep.

## **2.3 GYPSUM BOARD**

Gypsum board shall have square-cut ends, tapered or beveled edges and shall be maximum possible length.

### **2.3.1 Standard Gypsum Board**

Regular gypsum board shall conform to ASTM C 36, and shall be 48 inches wide.

### **2.3.2 Fire-Rated Gypsum Board**

Fire-rated gypsum board shall conform to ASTM C 36, and shall be Type X, 48 inches wide.

### **2.3.3 Foil-Backed Gypsum Board**

Foil-backed gypsum board shall conform to ASTM C 36, regular 48 inches wide. Gypsum board shall have aluminum foil vapor retarder laminated to back surface.

### **2.3.4 Shaftwall Coreboard**

Shaftwall coreboard shall conform to ASTM C 442. Coreboard shall be specifically manufactured for cavity shaftwall system, with water-resistant paper faces, square edges, single lengths to fit required conditions, 24 inches wide.

## **2.4 ACCESSORIES**

### **2.4.1 Taping and Embedding Compound**

Taping and embedding compound shall conform to ASTM C 475. Compound shall be specifically formulated and manufactured for use in embedding tape at gypsum wallboard joints and fastener heads, and shall be compatible with tape and substrate.

### **2.4.2 Finishing or Topping Compound**

Finishing or topping compound shall conform to ASTM C 475. Compound shall be specifically formulated and manufactured for use as a finishing compound for gypsum board.

### **2.4.3 All-Purpose Compound**

All-purpose compound shall be specifically formulated and manufactured to use as a taping and finishing compound, and shall be compatible with tape and substrate.

### **2.4.4 Joint Tape**

Joint tape shall conform to ASTM C 475 and shall be as recommended by gypsum board manufacturer.

### **2.4.5 Screws**

Screws shall conform to ASTM C 1002. Screws shall be self-drilling and self-tapping steel, Type G for gypsum board to gypsum board and Type S for light-gauge steel framing.

#### **2.4.6 Hangers**

Suspended ceiling runner channel hangers shall be soft, annealed steel wire not less than 0.1620 inch nominal diameter, conforming to ASTM A 853 or flat iron or steel straps, at least 3/32 by 7/8 inch size, coated with zinc, cadmium, or rust-inhibiting paint.

#### **2.4.7 Fastenings**

Tie wire, clips, rings, and other fastenings shall be corrosion-resisting steel conforming to ASTM A 580, composition 302, 304, or 316, Condition A, or nickel-copper alloy conforming to FS QQ-N-281, Class A or B, annealed condition except that walls, partitions, and other vertical surfaces not incorporated in ceiling construction may be erected with soft, annealed steel conforming to ASTM A 853.

##### **2.4.7.1 Clips**

Clips used in lieu of tie wire for securing the furring channels to the runner channels in ceiling construction shall be made from strip not less than 1/8 inch thick or shall be hairpin clip, formed of wire not less than 0.01620 inch nominal diameter. Other clips and rings or fastenings of similar materials shall be equivalent in holding power to that provided by tie wire for the specific application.

### **2.5 INSULATION**

#### **2.5.1 Blanket Insulation**

Insulation placed between the steel studs shall be batt or blanket type mineral wool conforming to ASTM C 665, Type III.

## **PART 3 EXECUTION**

### **3.1 INTERIOR WALL FRAMING**

Steel framing and furring members shall be installed in accordance with ASTM C 754. Members shall be in alignment with spacings not to exceed the maximum spacings indicated on drawings. Runners shall be aligned accurately at the floor and ceiling and securely anchored.

#### **3.1.1 Wall Openings**

The framing system shall provide for the installation and anchorage of the required subframes or finish frames for wall openings at doors, pass-through openings, and access panels. Partitions abutting continuous suspended ceilings shall be strengthened for rigidity at rough openings of more than 30 inches wide. Studs at openings shall be 20 gauge minimum bare metal thickness and spot grouted at jamb anchor inserts. Double studs shall be fastened together with screws and secured to floor and overhead runners. Two studs placed back-to-back shall be used for framing solid-core doors.

### **3.2 SHAFT WALL FRAMING**

The shaft wall system shall be reinforced in accordance with the system manufacturer's published instructions. Bucks, anchors, blocking and other items placed in or behind shaft wall framing shall be coordinated with electrical and mechanical work. Fireproofing materials which are damaged or removed during shaft wall construction shall be patched or replaced.

### **3.3 SUSPENDED CEILING FRAMING**

Suspended ceiling system framing shall be installed in accordance with ASTM C 754.

#### **3.3.1 Hangers**

Hangers shall be spaced not more than 48 inches along runner channels and 36 inches in the other direction or 42 inches in both directions unless otherwise indicated. Locations of hanger wires shall be coordinated with other work. Hangers at ends of runner channels shall be located not more than 6 inches from wall. Hanger wire shall be looped through metal clip attached to concrete with shot anchor. Sags or twists which develop in the suspended system shall be adjusted. Damaged or faulty parts shall be replaced.

#### **3.3.2 Main Runners**

Main runner channels shall be installed in accordance with ASTM C 754. Hanger wires shall be double strand saddle-tied to runner channels and the ends of hanger wire shall be twisted three times around itself. Main runners shall be located to within 6 inches of the paralleling wall to support the ends of cross furring. Main runners shall not come in contact with abutting masonry or concrete walls. Where main runners are spliced, ends shall be overlapped 12 inches with flanges of channels interlocked, and shall be securely tied at each end of splice with wire looped twice around the channels.

#### **3.3.3 Furring Channels**

Furring channels shall be spaced in accordance with ASTM C 754. Furring channels shall be secured to the runner channels and to structural supports at each crossing with tie wire, hairpin clips, or equivalent fastenings. Furring channels shall be located within 2 inches of parallel walls and beams, and shall be cut 1/2 inch short of abutting walls.

#### **3.3.4 Ceiling Openings**

Support members shall be provided as required at ceiling openings for access panels, recessed light fixtures, and air supply or exhaust. Support members shall be not less than 1-1/2 inch main runner channels and vertically installed suspension wires or straps shall be located to provide at least the minimum support specified herein for furring and wallboard attachment. Intermediate structural members not a part of the structural system, shall be provided for attachment or suspension of support members.

#### **3.3.5 Light Fixtures**

Light fixtures shall not be supported directly from suspended ceiling runners. Hanger wires for recessed or surface mounted light fixtures shall be anchored to structure at four corners of light fixtures, and additional wires shall be provided at appropriate locations to carry the weight of light fixtures.

### **3.4 APPLICATION OF GYPSUM BOARD**

Gypsum board shall be installed in accordance with ASTM C 840 and as specified. Edges and ends of gypsum boards shall be cut to obtain neat fitting joints. End joints of adjoining boards shall be staggered, and shall be staggered on opposite sides of wall. Boards shall be applied with moderate contact without forcing in place. Holes for pipes, fixtures or other small openings shall be cut with a tool which will provide a neat fit. Screws shall be driven so that the heads are slightly below the plane of paper face. Fracturing the paper face or damaging the core shall be avoided. Trim shall

be installed at external and internal angles formed by the intersecting gypsum board surfaces with other surfaces. Corner beads shall be installed to vertical and horizontal corners in accordance with manufacturer's published instructions.

#### **3.4.1 Foil-Backed Gypsum Board**

Foil-backed gypsum board shall be placed with reflective surface against framing members.

#### **3.5 INSULATION**

The actual installed thickness of insulation shall provide a thermal R as indicated on drawings. Installation, except as otherwise specified or shown, shall be in accordance with the manufacturer's instructions. Insulation shall be installed between ceiling framing members; foil face up. Where electrical outlets, ducts, pipes, vents or other utility items occur, insulation shall be placed on the outside of the item.

#### **3.6 TAPING AND FINISHING**

Gypsum board taping and finishing shall be performed in accordance with ASTM C 840. Boards shall be kept free of dirt, oil and other foreign matter that could cause a lack of bond. Screw heads, dents, gouges, and cut-outs shall be filled with joint compound and sanded. Accessories at exposed joints, edges, corners, openings, and similar locations shall be taped, floated with joint compound, and sanded to produce surfaces ready for gypsum board finishes.

#### **3.7 FIRE-RESISTANT ASSEMBLIES**

Gypsum wallboard construction for fire-rated assemblies shall be in accordance with UL-05, FM P8016 or GA 600 for the design number indicated on drawings.

#### **3.8 PATCHING**

Surface defects and damage shall be corrected as required to leave gypsum board smooth, uniform in appearance, and ready to receive finish as specified.

--End of Section--

SECTION 09510  
ACOUSTICAL CEILINGS

**PART I. GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 636                   (1992) Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels

ASTM E 1264               (1990) Standard Classification for Acoustical Ceiling Products

**1.2 GENERAL REQUIREMENTS**

Acoustical treatment shall consist of sound controlling units mechanically mounted on a ceiling suspension system. The unit size, texture, finish, and color shall be as specified. The location and extent of acoustical treatment shall be as shown on the drawings.

**1.3 DELIVERY AND STORAGE**

Materials shall be delivered to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Materials shall be carefully handled and stored in dry, watertight enclosures. Immediately before installation, acoustical units shall be stored for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed to assure temperature and moisture conditions.

**1.4 ENVIRONMENTAL REQUIREMENTS**

A uniform temperature of not less than 60 degrees F nor more than 80 degrees F and a relative humidity of not more than 70 percent shall be maintained before, during, and after installation of acoustical units.

**1.5 SCHEDULING**

Interior finish work such as gypsum board, concrete and terrazzo work shall be complete and dry before installation. Mechanical, electrical, and other work above the ceiling line shall be completed and heating, ventilating, and air conditioning systems shall be installed and operating in order to maintain temperature and humidity requirements.

**PART 2 PRODUCTS**

**2.1 ACOUSTICAL UNITS**

Acoustical units shall conform to ASTM E 1264, Class A, and the following requirements:

**2.1.1 Units for Exposed-Grid System**

Type: III.

NRC grade: 55 minimum when tested on mounting No. 7.

Pattern: c, and d.  
Nominal size: 24 by 24 inches.  
Edge detail: Trimmed and butt.  
Finish: Factory-applied standard finish.  
LR grade: 1.  
CAC range: 35-39

## **2.2 SUSPENSION SYSTEM**

Suspension system shall be exposed-grid and shall conform to ASTM C 635 for intermediate-duty systems. Surfaces exposed to view shall be aluminum or steel with a factory-applied white baked-enamel finish. Wall molding shall have a flange of not less than 15/16 inch and shall be provided with outside corner caps. Inside corner caps shall be provided where, due to the configuration of the installation, they are needed to produce a workmanlike appearance.

## **2.3 HANGERS**

Hangers shall be galvanized steel wire. Hangers and attachment shall support a minimum 300 pound ultimate vertical load without failure of supporting material or attachment.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

Acoustical work shall be provided complete with necessary fastenings, clips, and other accessories required for a complete installation. Mechanical fastenings shall not be exposed in the finished work. Hangers shall be laid out for each individual room or space. Hangers shall be placed to support framing around beams, ducts, columns, grilles, and other penetrations through ceilings. Main runners and carrying channels shall be kept clear of abutting walls and partitions. At least two main runners shall be provided for each ceiling span. Wherever required to bypass an object with the hanger wires, a subsuspension system shall be installed, so that all hanger wires will be plumb.

#### **3.1.1 Suspension System**

Suspension system shall be installed in accordance with ASTM C 636 and as specified herein. There shall be no hanger wires or other loads suspended from underside of steel decking.

##### **3.1.1.1 Plumb Hangers**

Hangers shall be plumb and shall not press against insulation covering ducts and pipes.

##### **3.1.1.2 Splayed Hangers**

Where hangers must be splayed (sloped or slanted) around obstructions, the resulting horizontal force shall be offset by bracing, countersplaying, or other acceptable means.

#### **3.1.2 Wall Molding**

Wall molding shall be provided where ceilings abut vertical surfaces. Wall molding shall be secured not more than 3 inches from ends of each length and not more than 16 inches on centers between end fastenings. Wall molding springs shall be provided at each acoustical unit in semi-exposed or concealed systems.



### **3.1.3 Acoustical Units**

Acoustical units shall be installed in accordance with the approved installation instructions of the manufacturer. Edges of acoustical units shall be in close contact with metal supports, with each other, and in true alignment. Acoustical units shall be arranged so that units less than one-half width are minimized. Units in exposed-grid system shall be held in place with manufacturer's standard hold-down clips, if units weigh less than 1 psf or if required for fire resistance rating.

### **3.2 CLEANING**

Following installation, dirty or discolored surfaces of acoustical units shall be cleaned and left free from defects. Units that are damaged or improperly installed shall be removed and new units provided as directed.

--End of Section--

SECTION 09650  
RESILIENT FLOORING

**PART I. GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM F 1066	(1987) Vinyl Composition Floor Tile
ASTM F 1303	(1990) Sheet Vinyl Floor Covering with Backing
ASTM F-1344	(1991) Rubber Floor Tile

FEDERAL SPECIFICATIONS (FS)

FS L-F-475	(Rev A; Am 1; Int Am 3) Floor Covering Vinyl, Surface (Tile and Roll), with Backing
FS L-F-001641	(Basic; Am 2) Floor Covering Translucent or Transparent Vinyl Surface with Backing
FS P-F-430	(Rev C; Am 1) Finish, Floor, Water-Emulsion (For Use on Light Colored Floors)
FS P-W-155	(Rev C; Int Am 1) Wax, Floor, Water-Emulsion
FS RR-T-650	(Rev D) Treads, Metallic and Nonmetallic, Skid Resistant

**1.2 DELIVERY AND STORAGE**

Materials shall be delivered to the building site in original unopened containers, shall be stored in a clean dry area with temperature maintained above 21 degrees C for 2 days prior to installation, and shall be stacked according to manufacturer's recommendations.

**1.3 ENVIRONMENTAL REQUIREMENTS**

Areas to receive resilient flooring shall be maintained at a temperature above 21 degrees C for 2 days before application, during application and 2 days after application. A minimum temperature of 13 degrees C shall be maintained thereafter.

**1.4 SCHEDULING**

Resilient flooring application shall be scheduled after the completion of other work which would damage the finished surface of the flooring.

## **PART 2 PRODUCTS**

### **2.1 Sheet Vinyl Flooring (with backing)**

Sheet vinyl flooring with backing shall conform to ASTM F 1303, Type II, Grade 1 (minimum wear layer thickness 1.27 mm (0.050 inches) and minimum overall thickness 2.03 mm. (0.080 inches).

#### **2.1.1 EDGE STRIP**

Edge strip shall be vinyl, 1 inch wide, and of thickness to match the flooring. Color shall match wall base color unless otherwise indicated.

### **2.2 ADHESIVE**

Adhesive for flooring and wall base shall be as recommended by the flooring manufacturer.

### **2.3 POLISH**

Polish shall conform to FS P-F-430 or FS P-W-155.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION/VERIFICATION OF CONDITIONS**

The Contractor shall verify that site conditions are in agreement with the design package and shall report all conditions that will prevent a proper installation. The Contractor shall not take any corrective action without written permission from the Government.

### **3.2 SURFACE PREPARATION**

Flooring shall be in a true, level plane, except where indicated as sloped. Before any work under this section is begun, all defects such as rough or scaling concrete, low spots, high spots, and uneven surfaces shall have been corrected, and all damaged portions of concrete slabs shall have been repaired as recommended by the flooring manufacturer. Concrete curing compounds, other than the type that does not adversely affect adhesion, shall be entirely removed from the slabs.

### **3.3 MOISTURE TEST**

The suitability of the concrete subfloor for receiving the resilient flooring with regard to moisture content shall be determined by a moisture test as recommended by the flooring manufacturer.

### **3.4 INSTALLATION OF SHEET VINYL FLOORING**

Sheet vinyl flooring shall be installed with adhesive in accordance with the manufacturer's installation instructions. Flooring shall be fitted to the room by hand cutting, straight scribing, as necessary to suit job conditions. Flooring shall be cut to, and fitted around, all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Seams shall be cut by overlapping or underscribing as recommended by the manufacturer. Seams and edges of sheet vinyl flooring in room areas shall be heat welded as recommended by the manufacturer. Flooring shall be installed with an integral coved base finished with a vinyl base cap.

### **3.5    INSTALLATION OF EDGE STRIPS**

Edge strips shall be secured with adhesive as recommended by the manufacturer. Edge strips shall be provided at locations where flooring termination is higher than the adjacent finished flooring, except at doorways where thresholds are provided.

### **3.6    INSTALLATION OF INTEGRAL COVED BASE**

Integral coved base shall be formed by extending the flooring material 100 mm onto the wall surface. Cove shall be supported by a plastic, rubber or wood coved filler having a minimum radius of 19 mm. Coved base shall be installed with adhesive in accordance with the manufacturer's instructions. A vinyl cap strip shall be provided at the top of the base. All seams shall be heat welded as recommended by the manufacturer.

### **3.7    CLEANING**

Immediately upon completion of installation of tile in a room or an area, flooring and adjacent surfaces shall be cleaned to remove all surplus adhesive. No sooner than 5 days after installation, flooring shall be washed with a nonalkaline cleaning solution, rinsed thoroughly with clear cold water.

### **3.8    PROTECTION**

From the time of laying until acceptance, flooring shall be protected from damage. Flooring which becomes damaged, loose, broken, or curled shall be removed and replaced.

--End of Section--

## SECTION 09680

### CARPET

#### PART I. GENERAL

##### 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

#### AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC 16	(1993) Test Method: Colorfastness to Light
AATCC 134	(1991) Test Method: Electrostatic Propensity of Carpets
AATCC 165	(1993) Test Method: Colorfastness to Crocking: Carpets - AATCC Crockmeter Method

#### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 297	(1993) Rubber Products - Chemical Analysis
ASTM D 418	(1993) Pile Yarn Floor Covering Construction
ASTM D 1335	(1967; R 1972) Tuft Bind of Pile Floor Coverings
ASTM D 1667	(1976; R 1990) Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam)
ASTM D 3490	(1980; R 1990) Flexible Cellular Materials - Bonded Urethane Foam
ASTM D 3574	(1995) Flexible Cellular Materials - Slab, Bonded, and Molded Urethane Foam
ASTM D 3936	(1980) Delamination Strength of Secondary Backing of Pile Floor Coverings
ASTM E 648	(1994a) Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

#### CARPET AND RUG INSTITUTE (CRI)

CRI 104	(1994) Commercial Carpet Installation Standard
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#### CODE OF FEDERAL REGULATIONS (CFR)

16 CFR 1630	Standard for the Surface Flammability of Carpet and Rugs
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GERMANY INSTITUTE FOR STANDARDIZATION (DEUTSCHES INSTITUT FÜR  
NORMUNG) (DIN)

DIN 54318

(1986) Machine-Made Textile Floor Coverings;  
Determination of Dimensional Changes Due to the  
Effects of Varied Water and Heat Conditions;  
Identical with Iso 2551 Edition 1981

## **1.2 DELIVERY AND STORAGE**

Materials shall be delivered to the site in the manufacturer's original wrappings and packages clearly labeled with the manufacturer's name, brand name, size, dye lot number, and related information. Materials shall be stored in a clean, dry, well ventilated area, protected from damage and soiling, and maintained at a temperature above 60 degrees F for 2 days prior to installation.

## **1.3 ENVIRONMENTAL REQUIREMENTS**

Areas in which carpeting is to be installed shall be maintained at a temperature above 60 degrees F for 2 days before installation, during installation, and for 2 days after installation. A minimum temperature of 55 degrees F shall be maintained thereafter for the duration of the contract. Traffic or movement of furniture or equipment in carpeted area shall not be permitted for 24 hours after installation. Other work which would damage the carpet shall be completed prior to installation of carpet.

## **1.4 WARRANTY**

Manufacturer's standard performance guarantees or warranties that extend beyond a one-year period shall be provided.

## **PART 2 PRODUCTS**

### **2.1 CARPET TYPE CP-1, CP-2 and CP-3**

Carpet shall have a current General Service Administration Contract and shall have an authorized Federal Supply Schedule Price List Catalogue. Schedule Contract shall be 72IA, Carpet, Carpet Tile, Tug and Carpet Cushion. Carpet shall be first quality; free of visual blemishes, streaks, poorly dyed areas, and other physical and manufacturing defects. Carpet materials and treatments shall be reasonably nonallergenic and free of other recognized health hazards.

#### **2.1.1 Physical Characteristics**

Carpet shall comply with the following:

- a. Carpet Fabrication: Tufted.
- b. Category: Broadloom 12 feet width.
- c. Pile Type: Loop Pile.
- d. Pile Fiber: 100% Branded Dupont Leumena nylon continuous filament with soil hiding/static control.
- e. Pile or Wire Height: .250"/.125 INCHES
- f. Gauge: 1/10 inch.

- g. Stitches and Tufts: 10 per square inch.
- h. Surface Pile Yarn Weight, (or Face Weight): 28 ounces per square yard. This does not include weight of backings. Weight of actual surface yarn exposed to wear above carpet backing shall be determined in accordance with ASTM D 418.
- i. Dye Method: Solution dyed - synthetic yarn which is spun from a colored solution with the filament impregnated with the pigment.
- j. Backing Materials: Primary backing materials shall be those customarily used and accepted by the trade for each type of carpet polypropylene. Secondary backing to suit project requirements shall be those customarily used and accepted by the trade for each type of carpet. Carpet shall have an attached cushion.
- k. Width: 12 feet minimum usable carpet.
- l. Pattern, texture, and color: As indicated in 09915 COLOR SCHEDULE.

### **2.3 Performance Requirements**

- a. Static Control: Static control shall be provided to permanently control static buildup to less than 3500 volts when tested at 20 percent relative humidity and 70 degrees F in accordance with AATCC 134.
- b. Flammability and Critical Radiant Flux Requirements: Carpet shall comply with 16 CFR 1630. Carpet shall have a minimum average critical radiant flux of 0.45 watts per square centimeter when tested in accordance with ASTM E 648.
- c. Tuft Bind: Tuft bind shall be a minimum 20 pound average force for loop pile average force for cut pile when tested in accordance with ASTM D 1335.
- d. Additional Performance Characteristics:
  - (1) Attached Cushion: The attached cushion shall be 18 pound density foam with Action Bac. The Foam weight shall be 27 ounces per square yards plus of minum 3 ounces. Attached cushion thickness shall be 120 mils plus or minum 2, Compression set 15% maximum; Compression Resistance 5.0 pounds per square inch minimum; tensile shall be 50 pounds per square inch or grater, Elongation 60% minimum; Tear, 5 pounds minimum; 15 year wear warrenty.
- e. Colorfastness to Crocking: Dry and wet crocking shall comply with AATCC 165 and shall have a minimum rating of step 4 on the AATCC Color Transference Chart for all colors.
- f. Colorfastness to Light: Colorfastness to light shall comply with AATCC 16 and shall have a minimum 4 grey scale rating after 40 hours.
- g. Delamination Strength: Delamination strength for tufted carpet with a secondary back shall be minimum of 2.5 lb./inch in accordance with ASTM D 3936.

## **2.4 ADHESIVES AND CONCRETE PRIMER**

Adhesives and concrete primers for installation of carpet shall be waterproof, nonflammable, meet local air-quality standards, and shall be as recommended by the carpet manufacturer. Seam adhesive shall be waterproof, nonflammable, and nonstaining as recommended by the carpet manufacturer.

## **2.5 MOLDING**

Molding shall be aluminum vinyl. Aluminum molding shall be a hammered surface, pinless clamp-down type, designed for the type of carpet being installed. Finish shall be natural color anodized prefinished, color. Floor flange shall be a minimum 38 mm 1-1/2 inches wide and face shall be a minimum 16 mm 5/8 inch wide. Vinyl molding shall be heavy-duty and designed for the type of carpet being installed. Floor flange shall be a minimum 50 mm 2 inches wide. Color shall match rubber base.

## **2.2 TAPE**

Tape for seams shall be as recommended by the carpet manufacturer for the type of seam used in installation.

## **PART 3 EXECUTION**

### **3.1 SURFACE PREPARATION**

Carpet shall not be installed on surfaces that are unsuitable and will prevent a proper installation. Holes, cracks, depressions, or rough areas shall be repaired using material recommended by the carpet or adhesive manufacturer. Floor shall be free of any foreign materials and swept broom clean. Before beginning work, subfloor shall be tested with glue and carpet to determine "open time" and bond.

### **3.2 MOISTURE TEST**

Concrete slab shall be tested for moisture content. The moisture content shall not exceed a hygrometer reading of 65 percent.

### **3.3 INSTALLATION**

Installation shall be in accordance with the manufacturer's instructions and CRI 104. Edges of carpet meeting hard surface flooring shall be protected with molding. Installation shall be in accordance with the molding manufacturer's instructions.

#### **3.3.1 Broadloom Installation**

Broadloom carpet shall be installed direct glue down and shall be smooth, uniform, and secure, with a minimum of seams. Seams shall be uniform, unnoticeable, and treated with a seam adhesive. Side seams shall be run toward the light where practical and where such layout does not increase the number of seams. Breadths shall be installed parallel, with carpet pile in the same direction. Patterns shall be accurately matched. Cutouts, as at door jambs, columns and ducts shall be neatly cut and fitted securely.

#### **3.3.2 Installation of Integral Coved Carpet Base**

Integral coved carpet base shall be formed by extending the flooring material 100 mm onto the wall surface. Cove shall be supported by a plastic, rubber or



wood coved filler having a minimum radius of 19 mm. Coved base shall be installed with adhesive in accordance with the manufacturer's instructions. A vinyl cap strip shall be provided at the top of the base. All seams shall be seamed as recommended by the manufacturer.

### **3.4 CLEANING AND PROTECTION**

#### **3.4.1 Cleaning**

After installation of the carpet, debris, scraps, and other foreign matter shall be removed. Soiled spots and adhesive shall be removed from the face of the carpet with appropriate spot remover. Protruding face yarn shall be cut off and removed. Carpet shall be vacuumed clean.

#### **3.4.2 Protection**

The installed carpet shall be protected from soiling and damage with heavy, reinforced, nonstaining kraft paper, plywood, or hardboard sheets. Edges of kraft paper protection shall be lapped and secured to provide a continuous cover. Traffic shall be restricted for at least 45 hours. Protective covering shall be removed when directed by the Contracting Officer.

### **3.5 REMNANTS**

Remnants remaining from the installation, consisting of scrap pieces more than 2 feet in dimension with more than 6 square feet total, shall be provided. Non-retained scraps shall be removed from site.

--End of Section--

SECTION 09900  
PAINTING, GENERAL

**PART I. GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 70/7460-1	(Rev H; Change 1 and 2) Obstruction Marking and Lighting
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FEDERAL SPECIFICATIONS (FS)

FS TT-E-489	(Rev H) Enamel, Alkyd, Gloss, Low VOC Content
FS TT-E-496	(Rev B; Am 3) Enamel: Heat-Resisting (400 degrees F.), Black
FS TT-E-505	(Rev B) Enamel (Odorless, Alkyd, Interior, High Gloss)
FS TT-E-506	(Rev K; Am 1) Enamel, Alkyd, Gloss, Tints and White (for Interior Use)
FS TT-E-508	(Rev C; Am 1) Enamel, Interior Semigloss, Tints and White
FS TT-E-509	(Rev C) Enamel, Odorless, Alkyd, Interior, Semigloss, White and Tints
FS TT-E-545	(Rev C) Primer (Enamel-Undercoat, Alkyd, Odorless, Interior, Flat, Tints and White)
FS TT-P-19	(Rev D; Am 1) Paint, Latex (Acrylic Emulsion, Exterior Wood and Masonry)
FS TT-P-29	(Rev K) Paint, Latex
FS TT-P-30	(Rev E; Am 1) Paint, Alkyd, Odorless, Interior, Flat, White and Tints
FS TT-P-37	(Rev D; Am 4 Reinstatement Notice) Paint, Alkyd Resin: Exterior Trim, Deep Colors
FS TT-P-38	(Rev E) Paint, Aluminum (Ready-Mixed)
FS TT-P-102	(Rev F) Paint, Oil (Alkyd Modified, Exterior, Low VOC)
FS TT-P-645	(Rev B) Primer, Paint, Zinc-Molybdate, Alkyd Type

## STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Paint 5	(1991) Zinc Dust, Zinc Oxide and Phenolic Varnish Paint
SSPC Paint 21	(1991) White or Colored Silicone Alkyd Paint
SSPC Paint 25	(1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (without Lead and Chromate Pigments)
SSPC SP 2	(1989) Hand Tool Cleaning
SSPC SP 3	(1989) Power Tool Cleaning
SSPC SP 7	(1991) Brush-Off Blast Cleaning

### 1.2 PACKAGING, LABELING, AND STORING

Paints shall be in sealed containers that legibly show the designated name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name of manufacturer. Pigmented paints shall be furnished in containers not larger than 20 liters.5 gallons. Paints and thinner shall be stored in accordance with the manufacturer's written directions and as a minimum stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors and at temperatures between 40 and 95 degrees F. Paints shall be stored on the project site or segregated at the source of supply sufficiently in advance of need to allow 30 days for testing.

### 1.3 APPROVAL OF MATERIALS

When samples are tested, approval of materials will be based on tests of the samples; otherwise, materials will be approved based on test reports furnished with them. If materials are approved based on test reports furnished, samples will be retained by the Government for testing should the materials appear defective during or after application. In addition to any other remedies under the contract the cost of retesting defective materials will be at the Contractor's expense.

### 1.4 ENVIRONMENTAL CONDITIONS

Unless otherwise recommended by the paint manufacturer, the ambient temperature shall be between 45 and 95 degrees F when applying coatings other than water-thinned, epoxy, and moisture-curing polyurethane coatings. Water-thinned coatings shall be applied only when ambient temperature is between 50 and 90 degrees F. Epoxy, and moisture-curing polyurethane coatings shall be applied only within the minimum and maximum temperatures recommended by the coating manufacturer. Moisture-curing polyurethane shall not be applied when the relative humidity is below 30 percent.

### 1.5 SAFETY AND HEALTH

Work shall comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis as specified in the CONTRACT CLAUSES. The Activity Hazard Analysis shall include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

#### **1.5.1 Worker Exposures**

Exposure of workers to chemical substances shall not exceed limits as established by ACGIH-02, or as required by a more stringent applicable regulation.

#### **1.5.2 Toxic Compounds**

Toxic compounds having ineffective physiological properties, such as odor or irritation levels, shall not be used unless approved by the Contracting Officer's representative.

#### **1.5.3 Training**

Workers having access to an affected work area shall be informed of the contents of the applicable material data safety sheets (MSDS) and shall be informed of potential health and safety hazard and protective controls associated with materials used on the project. An affected work area is one which may receive mists and odors from the painting operations. Workers involved in preparation, painting and clean-up shall be trained in the safe handling and application, and the exposure limit, for each material which the worker will use in the project. Personnel having a need to use respirators and masks shall be instructed in the use and maintenance of such equipment.

#### **1.5.4 Coordination**

Work shall be coordinated to minimize exposure of building occupants, other Contractor personnel, and visitors to mists and odors from preparation, painting and clean-up operations.

### **PART 2 PRODUCTS**

#### **2.1 PAINT**

The term "paint" as used herein includes emulsions, enamels, paints, stains, varnishes, sealers, cement-emulsion filler, and other coatings, whether used as prime, intermediate, or finish coat. Paint shall conform to the respective specifications listed for use in the painting schedules at the end of this section, except when the required amount of a material of a particular batch is 50 gallons or less, an approved first-line proprietary paint material with similar intended usage and color to that specified may be used. Additional requirements are as follows:

##### **2.1.1 Colors and Tints**

Colors shall be as selected from manufacturer's standard colors, as indicated. Manufacturer's standard color is for identification of color only. Tinting of epoxy, and urethane, paints shall be done by the manufacturer. Stains shall conform in shade to manufacturer's standard color. The color of the undercoats shall vary slightly from the color of the next coat.

##### **2.1.2 Lead**

Paints containing lead in excess of 0.06 percent by weight of the total nonvolatile content (calculated as lead metal) shall not be used.

##### **2.1.3 Chromium**

Paints containing zinc chromate or strontium chromate pigments shall not be used.

#### **2.1.4 Volatile Organic Compound (VOC) Content**

Paints shall comply with applicable state and local laws enacted to insure compliance with Federal Clean Air Standards and shall conform to the restrictions of the local air pollution control authority.

### **PART 3 EXECUTION**

#### **3.1 PROTECTION OF AREAS NOT TO BE PAINTED**

Items not to be painted which are in contact with or adjacent to painted surfaces shall be removed or protected prior to surface preparation and painting operations. Items removed prior to painting shall be replaced when painting is completed. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Surfaces contaminated by coating materials shall be restored to original condition.

#### **3.2 SURFACE PREPARATION**

Surfaces to be painted shall be clean and free of foreign matter before application of paint or surface treatments. Oil and grease shall be removed with clean cloths and cleaning solvents prior to mechanical cleaning. Cleaning solvents shall be of low toxicity with a flashpoint in excess of 100 degrees F. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

##### **3.2.1 Concrete, Stucco and Masonry Surfaces**

Concrete, stucco and masonry surfaces shall be allowed to dry at least 30 days before painting, except concrete slab on grade which shall be allowed to cure 90 days before painting. Glaze, efflorescence, laitance, dirt, grease, oil, asphalt, surface deposits of free iron and other foreign matter shall be removed prior to painting. Surfaces to receive polyurethane, chlorinated rubber or epoxy coatings shall be acid-etched or mechanically abraded as specified by the coating manufacturer, rinsed with water, allowed to dry, and treated with the manufacturer's recommended conditioner prior to application of the first coat.

##### **3.2.2 Ferrous Surfaces**

Ferrous surfaces including those that have been shop-coated, shall be solvent-cleaned. Surfaces that contain loose rust, loose mill scale, and other foreign substances shall be cleaned mechanically with hand tools according to SSPC SP 2, power tools according to SSPC SP 3 or by sandblasting according to SSPC SP 7. Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection.

##### **3.2.3 Nonferrous Metallic Surfaces**

Galvanized, aluminum and aluminum-alloy, lead, copper, and other nonferrous metal surfaces shall be solvent-cleaned in accordance with SSPC SP 1.

#### **3.2.4 Gypsum Board Surfaces**

Gypsum board surfaces shall be dry and shall have all loose dirt and dust removed by brushing with a soft brush, rubbing with a cloth, or vacuum-cleaning prior to application of the first-coat material. A damp cloth or sponge may be used if paint will be water-based.

#### **3.2.5 Mastic-Type Surfaces**

Mastic-type surfaces shall be prepared by removing foreign material.

#### **3.2.6 Wood Surfaces**

Wood surfaces shall be cleaned of foreign matter. Wood surfaces adjacent to surfaces to receive water-thinned paints shall be primed and/or touched up before applying water-thinned paints. Small, dry seasoned knots shall be scraped, cleaned, and given a thin coat of commercial knot sealer, before application of the priming coat. Pitch on large, open, unseasoned knots and all other beads or streaks of pitch shall be scraped off, or, if it is still soft, removed with mineral spirits or turpentine, and the resinous area shall be thinly coated with knot sealer. Finishing nails shall be set, and all holes and surface imperfections shall be primed. After priming, holes and imperfections in finish surfaces shall be filled with putty or plastic wood filler, colored to match the finish coat if natural finish is required, allowed to dry, and sanded smooth. Putty or wood filler shall be compatible with subsequent coatings.

### **3.3 MIXING AND THINNING**

When thinning is approved as necessary to suit surface, temperature, weather conditions, or application methods, paints may be thinned in accordance with the manufacturer's directions. When thinning is allowed, paints shall be thinned immediately prior to application with not more than 1 pint of suitable thinner per gallon. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed local limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

### **3.4 APPLICATION**

Painting practices shall comply with applicable state and local laws enacted to insure compliance with Federal Clean Air Standards. Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application. Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces. Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

#### **3.4.1 Ventilation**

Affected areas shall be ventilated during paint application so that workers exposure to chemical substances shall not exceed limits as established by ACGIH-02, or as required by a more stringent applicable regulation. Interior work zones having a volume of 10,000 cubic feet or less shall be ventilated at

a minimum of 2 air exchanges per hour. Ventilation in larger work zones shall be maintained by means of mechanical exhaust. Solvent vapors shall be exhausted outdoors, away from air intakes and workers. Return air inlets in the work zone shall be temporarily sealed before start of work until the coatings have dried.

#### **3.4.2 Respirators**

Operators and personnel in the vicinity of operating paint sprayers shall wear respirators.

#### **3.4.3 First Coat**

The first coat on gypsum wallboard, and other surfaces shall include repeated touching up of suction spots or overall application of primer or sealer to produce uniform color and gloss. Excess sealer shall be wiped off after each application. The first coat on both faces of wood doors shall be applied at essentially the same time.

#### **3.4.4 Timing**

Surfaces that have been cleaned, pretreated, and otherwise prepared for painting shall be given a coat of the specified first coat as soon as practical after such pretreatment has been completed, but prior to any deterioration of the prepared surface. Sufficient time shall elapse between successive coats to permit proper drying. This period shall be modified as necessary to suit weather conditions. Oil-based or oleoresinous solvent-type paints shall be considered dry for recoating when the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and the application of another coat of paint does not cause the undercoat to lift or lose adhesion. Manufacturer's instructions for application, curing and drying time between coats of two-component systems shall be followed.

#### **3.4.5 Ferrous-Metal Primer**

Primer for ferrous-metal shall be applied to ferrous surfaces to receive paint other than asphalt varnish prior to deterioration of the prepared surface. The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified ferrous-metal primer prior to application of finish coats.

### **3.5 SURFACES TO BE PAINTED**

Surfaces listed in the painting schedules at the end of this section, other than those listed in paragraph SURFACES NOT TO BE PAINTED, shall be painted as scheduled.

### **3.6 SURFACES NOT TO BE PAINTED**

Surfaces in the following areas are not to be painted: per finish schedule. In addition surfaces of hardware, fittings, and other factory finished items shall not be painted.

### **3.7 CLEANING**

Cloths, cotton waste and other debris that might constitute a fire hazard shall be placed in closed metal containers and removed at the end of each day. Upon completion of the work, staging, scaffolding, and containers shall be removed from the site or destroyed in an approved manner. Paint and other deposits on adjacent surfaces shall be removed and the entire job left clean and acceptable.

### 3.8 PAINTING SCHEDULES

The following painting schedules identify the surfaces to be painted and prescribe the paint to be used and the number of coats of paint to be applied. Contractor options are indicated by -----or----- between optional systems or coats.

#### EXTERIOR PAINTING SCHEDULE

Surface	First Coat	Second Coat	Third Coat
Concrete, unless otherwise specified.	FS TT-P-19	FS TT-P-19	None
Galvanized.	SSPC Paint 5	FS TT-P-102	FS TT-P-102
Handrails Doors and Door Frames	SSPC Paint 5	FS TT-P-37	FS TT-P-37

#### INTERIOR PAINTING SCHEDULE

Surface	First Coat	Second Coat	Third Coat
Ferrous metal factory-primed mechanical and electrical equipment.	FS TT-E-489,  -----or----- SSPC Paint 21, Type I	FS TT-E-489,  SSPC Paint 21, Type I	None  None
Wood: unless otherwise specified.	FS TT-E-545	FS TT-P-30	None
Metal: Convactor enclosures, electrical conduit runs, metallic tubing, uninsulated ducts and pipes, pipe hangers, louvers, grilles, and air outlets	SSPC Paint 5	FS TT-E-545	FS TT-E-506



Aluminum: in areas having painted adjacent	FS TT-P-645	FS TT-E-509
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Galvanized surface: surfaces.	SSPC Paint 5	Two coats to match adjacent areas FS TT-E-489                      FS TT-E-489
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Oil-based caulking compound.	FS TT-P-38	Same as adjacent areas
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--End of Section--

## SECTION 09901

### SEAMLESS ACRYLIC WALL COATINGS

#### **PART I. GENERAL**

##### **1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM)

ASTM E 84 (1991; Rev. 3) Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM D 1653 Water Vapor Permeability

##### **1.2 DELIVERY AND STORAGE**

The Contractor shall be responsible for the receipt, storage, and handling of materials and supplies necessary to provide a complete installation. Materials shall be delivered to the job site in original, new and unopened packages and containers bearing manufacturers's name, label and following information: Name or title of materials, manufacture's stock and /or batch number, date of manufacture, contents of containers including color name and number. Materials shall be store in tightly covered containers that are clean and free from foreign materials and residue. Protect materials from temperatures below 32 degree F and not to exceed 100 degrees F.

##### **1.3 ENVIRONMENTAL REQUIREMENTS:**

The Contractor shall apply materials only when surface temperature is between 60 and 100 degrees F. If dry conditions cause rapid drying of the materials before proper finishes can be completed, eliminate breezes, fans and other air movements which contribute to the problem and if necessary dampen the substrate with finely misted water just prior to application. Protect finishes from casual impact for a period of forth eight hours after installation. Protect from heavy traffic for a period of at least three days. Protect all surfaces and adjacent areas not intended to be coated and clean immediately any spillage, droppings and other extraneous contact of the materials with other surfaces. Remove masking tape and clean all adjacent surfaces at the end of each work day.

##### **1.4 EXTRA MATERIALS**

The Contractor shall provide at least three gallons of each batch number of materials installed with a list identifying where each batch number was installed.

#### **PART 2 PRODUCTS**

##### **2.1 SEAMLESS ACRYLIC WALL COATINGS**

###### **2.1.1 SEAMLESS ACRYLIC WALL COATINGS**

Provide texture and color as stated in Section 09915 COLOR SCHEDULE for both walls and ceilings

#### 2.1.1.1 Performance Characteristics

Finished and fully cured (28 days) materials shall have the following minimum performance characteristics:

Barcoll Hardness Index	35.0 or greater
ASTM-E-84 Flame Spread	8.5 or less
Smoke Contribution	7.0 or less
ASTM E-96B Water Vapor Permeance	27.5 English Perms or greater
Scrubability	Two hundred strokes of stiff brush with soap and water 0.001 inch erosion or less
<u>Solvent Resistance</u> (1 hour soak)	
Water	slight softening*
Detergent	no change
Ethanol	no change
Naphtha	no change
Ammonium Hydroxide	slight softening*
Bleach (household)	slight softening*
409 Commercial Cleaner	Slight softening*
Paint Remover	slight softening*
Mineral spirits	no change

\* Slight softening is noted to mean a temporary softening. Original hardness regained after drying.

Stain Resistance: (10 hour soak and wash with Commercial 409 Cleaner or bleach or water)

Water	no stain visible
Blood	no stain visible
Urine	no stain visible
Coffee	no stain visible
Tea	no stain visible
Blueberry	no stain visible
mustard	no stain visible

Mildew Resistance: No visible mildew after incubation for ninety days in 95 degree F and 90% relative humidity under high contamination conditions.

Color Pigments All pigments shall be pure, non-fading and bleach resistant.

Color Selection: Provide at least sixty factory colors and factory custom color service.

#### 2.1.1.2 Material Warranty

The materials shall have a 10 year warranty. There shall also be a 10 year warranty against mold and mildew.

## **PART 3 EXECUTION**

### **3.1 SURFACE PREPARATION**

#### **3.1.1 General**

(a) Perform preparation and cleaning procedures in accordance with manufacturer's recommendations and as herein specified for each particular substrate conditions. All work must be schedule before flooring materials are installed.

(b) Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish coated or provide masking or other protection prior to surface coatings operations. Following completion of coating of each space or areas, reinstall removed items and remove masking and other protection materials.

(c) Cleans surfaces to be coated before applying any materials. Remove oils and grease prior to mechanical cleaning. Program cleaning and coating so that contaminates from cleaning process will not fall into wet or newly coated surface.

#### **3.1.2 Surface Preparation**

(a) Drywall: Prepare drywall to industry acceptable standard for hanging vinyl wall covering. Remove excess gypsum compound dust. Dampen surface slightly with a light spray mist of water just prior to application of acrylic wall coating materials.

(b) Existing Painted Surfaces: Clean surface with soap and water to remove oils, dust and other contaminates. Lightly sand surface to improve adhesion (total removal of gloss is not necessary).

### **3.2 INSTALLATION**

#### **3.2.1 MATERIALS PREPARATION**

Prepare, stir and thin all materials according to the manufacturer's written instructions. Do not leave containers open for more than one hour. If hardened material accumulates on the sides of the container, remove the material to a clean container before use.

#### **3.2.2 Application**

(a) Apply coating materials in accordance with the manufacturer's instructions and recommendations as required to achieve the appearance of the approved samples and performance as specified herein. Coating materials shall be used as a system which may include primers or undercoatings as required by the manufacturers's installation directions.

(b) Final dry film thickness shall be a minimum average of 20 mils. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces.

### **3.2.3 Certified Applicator**

All contract applicators/installers must have been factory trained and certified to apply materials prior to submitting a bid and samples. Applicators shall submit a photocopy of factory Certificate as proof of factory certification.

### **3.3 CLEANUP AND PROTECTION**

(a) Cleanup: During progress of work, remove from site discarded coating materials, cans, rags, and trash at the end of each work day.

(b) Protection: Protect work of other trades, whether to be coated or not, against damage by coating work. Correct any damage by cleaning, repairing or replacing and refinishing as acceptable.

(c) Protect new work from damage by other trades.

--End of Section--

## SECTION 09915

### COLOR SCHEDULE

#### **PART I. GENERAL**

##### **1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

##### **1.2 GENERAL**

This section covers only the color of the exterior and interior materials and products that are exposed to view in the finished construction. The word "color" as used herein includes surface color and pattern. Requirements for quality and method of installation are covered in other appropriate sections of the specifications. Specific locations where the various materials are required are shown on the drawings. Items not designated for color in this section may be specified in other sections. When color is not designated for items, the Contractor shall propose a color for approval.

##### **1.3 SUBMITTALS**

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL PROCEDURES:

SD-14 Samples

Color board; GA; CD

1 sets of color boards, 120 days after the Contractor is given Notice to proceed, complying with the following requirements:

- a. Color boards shall reflect all actual finish textures, patterns, and colors required for this contract.
- b. Materials shall be labeled with the finish type, manufacturer's name, pattern, and color reference.
- c. Samples shall be on size A4 or 8-1/2 by 11 inch boards with a maximum spread of size A1 or 25-1/2 by 33 inches for foldouts.
- d. Samples for this color board are required in addition to samples requested in other specification sections.
- e. Color boards shall be submitted to the following addresses:

#### **PART 2 PRODUCTS**

##### **2.1 REFERENCE TO MANUFACTURER'S COLOR**

Where color is shown as being specific to one manufacturer, an equivalent color by another manufacturer may be submitted for approval. Manufacturers and materials specified are not intended to limit the selection of equal colors from other manufacturers.

## **2.2 COLOR SCHEDULE**

The color schedule lists the colors, patterns and textures required for exterior and interior finishes, including both factory applied and field applied colors.

### **2.2.1 Exterior Walls**

Exterior wall colors shall apply to exterior wall surfaces including recesses at entrances and projecting vestibules. Conduit shall be painted to closely match the adjacent surface color. Wall color shall be provided to match the colors listed below.

- a. Insulation and Finish System: Thorowall H System, Fine Finish, Mission White

### **2.2.2 Exterior Trim**

Exterior trim shall be provided to match the colors listed below.

- a. Doors and Door Frames: Glidden 78-72
- b. Windows (mullion, muntin, sash, trim, and sill): Dark Bronze
- c. Fascia: Glidden 78-67
- d. Downspouts, Gutter, Louvers, and Flashings: 78-67
- e. Handrails and Balcony Rails: Glidden 78-69
- f. Soffits and Ceilings: Glidden 78-67
- g. Signage: Glidden 78-69
- h. Caulking and Sealants: Match adjacent surface.

### **2.2.3 Exterior Floor**

Exterior floor finish, noted and scheduled as "Epoxy", at balconies, corridors, stairs and landings shall be as specified in Specification Section 09800, Urethane Floor Coating.

Color: DEX-O-TEX, 565 Beige, Posi-Tred, Medium Finish.

### **2.2.4 Interior Floor Finishes**

Flooring materials shall be provided to match the colors listed below. Flooring materials shall be provided in the areas indicated.

- a. Carpet:

**NOTE: The General Contractor has permission to purchase the carpet directly from the Masland Mill at GSA pricing.**

Masland Carpet  
National Accounts Manager for Government Sales  
Brett Bennett  
334-675-9080  
1-800-633-0468

**CP-1**

**TYPICAL LIVING/SLEEPING ROOMS AND CLOSETS MODULE A AND B**

**FIRST FLOOR ONLY**

**SECTORS (A), (B), (E) AND (D)**

CP-1: Masland'S "Regiment #7801", with attached cushion,  
COLOR: 08154 Beret

**CP-2**

**TYPICAL LIVING/SLEEPING ROOMS AND CLOSETS MODULE A AND B**

**SECOND FLOOR ONLY**

**SECTORS (A), (B), (E) AND (D)**

CP-2: Masland'S "Regiment #7801", with attached cushion,  
COLOR: 08166 Triage

**CP-3**

**TYPICAL LIVING/SLEEPING ROOMS AND CLOSETS MODULE A AND B**

**THIRD FLOOR ONLY**

**SECTORS (A), (B), (E) AND (D)**

CP-3: Masland'S "Regiment #7801", with attached cushion,  
COLOR: 08151 Salute

- b. Sheet Vinyl: NOTE: PROVIDE A 3 BY 3 FOOT SQUARE OF SV-1  
AT THE ENTRY DOOR OF ALL MODULES IN  
ALL SECTORS.

SV-1: ARMSTRONG, Pattern: "PETIT POINT"  
Color: 86053 Sandstone

**2.2.5 Interior Base Finishes**

Base materials shall be provided to match the colors listed below. Base materials shall be provided at the areas indicated.

- a. Carpet Base: Provide carpet base for all modules.  
FIRST FLOOR: CP-1  
SECOND FLOOR: CP-2  
THRID FLOOR: CP-3
- b. EDGE STRIP:  
FIRST FLOOR: Natural finish Aluminum
- c. Intragal Cove Sheet Vinyl Base: SV-1  
Welding Rod Color: 02415 Biscuit

**2.2.6 Interior Wall Finishes**

Interior wall color shall apply to the entire wall surface, including reveals, vertical furred spaces, grilles, diffusers, electrical and access panels, and piping and conduit adjacent to wall surfaces unless otherwise specified. Items not specified in other paragraphs shall be painted to match adjacent wall surface. Wall materials shall be provided to match the colors listed below.

- a. SEAMLESS ACRYLIC WALL COATINGS:
- AWC-1: Duroplex Seamless Wall finish;  
Surface Texture: Light Stomp  
Color: 500 Howard White  
Duraplex Manufacture  
1-800-537-6111



### **2.2.7 Interior Ceiling Finishes**

Ceiling colors shall apply to ceiling surfaces including soffits, furred down areas, grilles, diffusers, registers, and access panels. Ceiling color shall also apply to joist, underside of roof deck, and conduit and piping where joists and deck are exposed and required to be painted. Ceiling materials shall be provided to match the colors listed below.

#### **SEAMLESS ACRYLIC WALL COATINGS:**

- a. TP-2: Duroplex Seamless finish  
Surface Texture: Fine Sand  
Color: No.100 White  
Duraplex Manufacturer  
1-800-537-6111  
John Wise Sales Representative

### **2.2.8 Interior Trim**

Interior trim shall be provided to match the colors listed below.

- a. Doors: Paint with semi-gloss latex color to match walls
- b. Door Frames: Paint with semi-gloss latex color to match walls.
- c. Windows (mullion, muntin, sash, trim, and stool): Paint color to match walls.
- d. Window Sills: Corian, Bisque

### **2.2.9 Interior Window Treatment**

Window treatments shall be provided to match the colors listed below.

- a. Horizontal Blinds: Leveloer, Color: Alabaster

### **2.2.10 Interior Miscellaneous**

Miscellaneous items shall be provided to match the colors listed below.

- a. Shower stalls units: Color: White
- b. Plastic Laminate Kitchen cabinets and counter tops:  
Nevarmar MR-2-6T
- c. Exterior Nameplate Door Signs:  
Systems 2/90  
5510 33re St. SE Grand Rapids, MI 49512,  
(1-800-777-4310 FAX 616-949-5959)  
  
Copy/Message: Color: C-BE Beige  
  
Background color: S-MG Medium Grey  
  
End Caps, Rails and Insert panel Background Color: S-MG
- d. Signage Background Color

- e. Wall Switch Handles and Standard Receptacle Bodies: Almond
- f. Electrical Device Cover Plates and Panels: Almond.
- g. Shower Door: Frosted glass with natural color trim.

**PART 3 EXECUTION (Not Applicable)**

--End of Section--

## **SECTION 10431**

### **EXTERIOR NAMEPLATE DOOR SIGNAGE**

#### **PART I. GENERAL**

##### **1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

##### ALUMINUM ASSOCIATION (AA)

AA DAF-45 (1980) Designation System for Aluminum Finishes

##### AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1 (1994) Safety Glazing Materials Used in Buildings

##### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 84 (1994) Surface Burning Characteristics of Building Materials

##### CODE OF FEDERAL REGULATIONS (CFR)

36 CFR 1191 Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities

##### NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 505 (1988) Metal Finishes Manual for Architectural and Metal Products; Section: Applied Coatings

##### SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE AMS 3611 (1964; Rev C) Plastic Sheet, Polycarbonate General Purpose

##### **1.2 GENERAL**

Exterior nameplate door signage, herein referenced as "signs or signage" shall be of the size and type shown on the drawings, shall conform to the requirements specified herein, and shall be provided on each and every dormitory room exterior door, on all floors and in all sectors. Signs shall be complete with lettering, framing as detailed, and related components for a complete installation. Materials shall be the standard product of a manufacturer regularly engaged in the manufacture of the products. The manufacture shall have a current General Service Administrative Signage Contract.

### **1.3 SUBMITTALS**

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section PROCEDURES:

SD-01 Data

Signage; GA; CD

Manufacturer's descriptive data, catalog cuts, and installation instructions.

SD-04 Drawings

Signage; GA; ED

Drawings showing elevations; dimensions, details, and methods of mounting or anchoring; shape and thickness of materials; and details of construction. A schedule indicating the location of sign shall be included.

SD-06 Instructions

Signage; FIO; CD

Manufacturer's installation instructions and cleaning instructions.

SD-14 Samples

Signage; GA; CD

One sample of signage. The sample shall consist of a complete sign with messages and room numbers, window inserts, and memo holder. Samples may be installed in the work, provided each sample meets the color requirements and is identified and location recorded.

### **1.4 DELIVERY AND STORAGE**

Materials shall be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging, and stored in a clean, dry area.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

Sign components are to be by a single manufacturer including all necessary, fitting and fastenings. Color of sign products shall be in accordance with Section 09915 COLOR SCHEDULE. Signs shall be a combination of subsurface copy graphics, tactile copy graphics, window inserts, sliding window and memo holder. Surface applied vinyl copy/graphics will be disapproved.

### **2.2 ALUMINUM**

Aluminum alloy products shall conform to ASTM B 221 for extrusions. Aluminum extrusions shall be provided at least 1/8 inch thick and aluminum plate or sheet at least 16 gauge, 0.0508 inch thick.

### **2.3 ORGANIC COATING**

Surfaces shall be cleaned, primed, and given a Semi-gloss baked enamel or two-component acrylic polyurethane finish in accordance with NAAMM AMP 505 with total dry film thickness not less than 1.2 mils.

## **2.4 LEXAN LENS**

Lexan lens shall be in accordance with the flammability requirements of ASTM E 84 and shall conform to ANSI Z97.1

## **2.5 ANCHORS AND FASTENERS**

Exposed anchor and fastener materials shall be compatible with metal to which applied and shall match in color and finish.

## **2.6 GRAPHICS**

### **2.6.1 Tactile Graphics for Room Numbers**

Room numbers shall be tactile (perceptible to touch) and shall comply with 36 CFR 1191. Phenolic photo polymer inserts with raised copy shall be raised .031 inches from the background surface. No handcut copy will be accepted. Edges that are nicked, cut, or ragged will not be acceptable. Numbers, Characters and symbols shall contrast in color with their background.

### **2.6.2 Subsurface Graphics for Room Messages**

Subsurface copy/graphics shall conform to the following:  
Textured .030 inch clear Polycarbonate face with subsurface applied using the silkscreen process. Silkscreened images shall be executed with photo screens prepared from original art. No handcut screens will be accepted. Original art shall be defined as earthwork that is a first generation stencil of the original specified art. Edges and corners shall be clean.

### **2.6.3 Messages and Room Numbers**

See drawings for messages. Room numbers are to be based on the base installation standards and guidance and are to be approved and coordinated with the Government Contracting Representative and with the Base Civil Engineer Representative. Typeface: Helvetica medium. Type size as indicated on drawings.

### **2.6.4 Mounting**

Mount signs as recommended by the manufacturer and at the locations and heights as indicated.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

Signs shall be installed in accordance with approved manufacturer's instructions. Signs shall be installed at all dormitory room exterior doors, on all floors and in all sectors. Signs shall be installed plumb and true at mounting heights indicated. Signs shall not be installed until finishes on such door surfaces have been completed.

#### **3.1.1 Anchorage**

Anchorage shall be in accordance with approved manufacturer's instructions.

#### **3.1.2 Protection and Cleaning**

The work shall be protected against damage during construction.

--End of Section--

## SECTION 10800

### TOILET ACCESSORIES

#### PART 1 GENERAL

##### 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

##### COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-2380 (Basic) Dispenser, Paper Towel

##### FEDERAL SPECIFICATIONS (FS)

FS WW-P-541/GEN (Rev E; Am 1) Plumbing Fixtures

FS WW-P-541/8 (Rev B; Am 1) Plumbing Fixtures (Accessories, Land Use)

##### 1.2 DELIVERY, STORAGE, AND HANDLING

Toilet accessories shall be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging and stored in a clean, dry area protected from construction damage and vandalism.

#### PART 2 PRODUCTS

##### 2.1 MANUFACTURED UNITS

Toilet accessories shall be provided where indicated on plan. Each accessory item shall be complete with the necessary mounting plates, shall be of sturdy construction with corrosion resistant surface.

##### 2.1.1 Anchors and Fasteners

Anchors and fasteners shall be capable of developing a restraining force commensurate with the strength of the accessory to be mounted and shall be suited for use with the supporting construction. Exposed fasteners shall be of tamperproof design and shall be finished to match the accessory.

##### 2.1.2 Finishes

Finishes on metal shall be provided as follows:

Metal	Finish
Stainless steel	No. 4 satin finish
Carbon steel, copper alloy, and brass	Chromium plated, bright

##### 2.2 ACCESSORY ITEMS

Accessory items shall conform to the requirements specified below.

### **2.2.3 Medicine Cabinet (MC)**

Medicine cabinet shall conform to FS WW-P-541/GEN and FS WW-P-541/8, Type III. Except door will be paintable metal in lieu of mirror. Width, height and depth of cabinet shall be as indicated.

### **2.2 Paper Towel Dispenser (PTD)**

Paper towel holder shall conform to CID A-A-2380, to hold one paper roll, shall be constructed of not less than 22 gauge Type 304 stainless steel, and shall be surface mounted.

### **2.2.3 Towel bar (TB)**

Towel bar shall be Type 304 stainless steel 3/4 inch OD by 0.049 inch conforming to FS WW-P-541/GEN and FS WW-P-541/8, CLASS 1; installation conditions.

### **2.2. Robe Hook (RH)**

Robe Hook shall have concealed wall fastenings, and a pin integral with or permanently fastened to wall flange. Maximum projection shall be 4 inches. Design shall be consistent with design of other accessory items.

### **2.2.5 Toilet Tissue Dispenser (TTD)**

Toilet tissue holder shall be Type II - surface mounted with two rolls of tissue mounted horizontally. Holder shall be stainless steel, satin finish.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

Toilet accessories shall be securely fastened to the supporting construction in accordance with the manufacturer's approved instructions. Accessories shall be protected from damage from the time of installation until acceptance.

--End of Section--

## SECTION 12390

### CABINETS AND CONTERTOPS

#### **PART 1 GENERAL**

##### **1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

##### BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A156.9 (1988) Cabinet Hardware

##### KITCHEN CABINET MANUFACTURERS ASSOCIATION (KCMA)

KCMA A161.1 (1990; Errata May 1991) Recommended Performance & Construction Standards for Kitchen and Vanity Cabinets

##### NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LD 3 (1991) High-Pressure Decorative Laminates

##### **1.2 DESIGN**

Cabinets shall be wood, factory-fabricated and finished in the manufacturer's standard sizes and finishes of the type, design, and configuration indicated. Cabinets shall be constructed as specified and shall meet the requirements of KCMA A161.1. Wall and base cabinet assemblies shall consist of individual units joined into continuous sections. Fastenings shall be accomplished to permit removal and replacement of individual units without affecting the remainder of the installation. Counters shall be provided with watertight sink rim when indicated. Drawers shall be removable and shall be equipped with position stops to avoid accidental complete withdrawals. Shelves shall be fixed or adjustable as indicated.

##### **1.3 DELIVERY AND STORAGE**

Cabinets shall be delivered to the jobsite wrapped in a protective covering. Cabinets shall be stored in an adequately ventilated, dry location that is free of dust, water, or other contaminants and in a manner to permit access for inspection and handling. Cabinets shall be handled carefully to prevent damage to the surfaces. Damaged items that cannot be restored to like-new condition shall be replaced.

#### **PART 2 PRODUCTS**

##### **2.1 CABINETS**

Wall and base cabinets shall be of the same construction and same outside appearance. Door and drawer design shall be flush panel. Shelves shall be fixed. Shelves shall be minimum thick plywood or minimum 1/2 inch thick 45 pounds density particle board.

##### **2.1.1 FRAME TYPE CABINETS**

The cabinets shall be constructed with frame fronts and solid ends, or frame construction throughout. Frame members shall be 3/4 inch thick by 1-1/2 inch



wide; kiln-dried hardwood, glued together, and shall be either mortised and tenoned, dovetailed or doweled, nailed, stapled or screwed. Top and bottom corners shall be braced with either hardwood blocks that are glued together with water resistant glue and nailed in place, or metal or plastic corner braces. Backs of wall cabinets shall be 1/8 inch thick plywood or tempered hardboard. Backs of base and tall cabinets shall be 3/8 inch thick hardwood plywood or 3/8 inch thick, 45 pound density particle board. Bottoms of cabinets shall be minimum 3/8 inch thick plywood sound grade and shall be braced with wood members glued in place. Cabinet ends shall be 5/8 inch thick hardwood plywood 5/8 inch thick, 45 pound density particle board core.

## **2.2 COUNTERTOPS AND BACKSPLASH**

### **2.2.1 General**

Countertop and backsplash shall be constructed of 3/4 inch thick plywood or 3/4 inch thick, 45 pound density particle board core and shall be post formed cove type. Cove type shall be a single unit with self-edging and plastic laminate coved at the juncture of the countertop and backsplash. Backsplash shall extend 4 inches above counter. Edging and trim shall consist of plastic laminate cut and fitted to all exposed edges. Backsplash at range shall be stainless steel and shall extend to bottom of hood.

### **2.2.2 Sink Rims**

Sink rims shall be of the corrosion resistant steel clamping type, sized to the sink, and a standard product of a manufacturer regularly producing this type of equipment.

## **2.3 FINISH**

### **2.3.1 Cabinet Finish**

Cabinets shall be provided with a factory-applied high pressure laminate. Wood doors, drawer and cabinet fronts, shall have edges banded in same material as fronts. Exposed interior surfaces shall have melamine finish.

## **2.4 HARDWARE**

Hardware shall conform to BHMA A156.9, shall be suitable for kitchen cabinet use, and shall include all miscellaneous hardware for a complete installation. Door hinges shall be self-closing type. Drawer runners shall have nylon rollers standard with the manufacturer. Hardware and fastenings for doors and drawers with particle board cores shall be of the through-bolt type. The types and finishes of hardware shall be as follows.

### **BHMA DESIGNATION**

<u>Quantity/Location</u>	<u>ITEM/NO.</u>	<u>FINISH</u>
2 ea. per door	Hinge, B01602	603
2 ea. per door	Slide, B05051	603
1 ea. per drawer or door	Pull, B02011	624

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

Cabinets shall be installed level, plumb, and true to line, and shall be attached to the walls or floors with suitable devices to securely anchor each unit. Countertops, accessories, and hardware shall be installed as indicated. Installation shall be in accordance with the manufacturer's approved printed instructions. The inner edge of sink cut-outs in laminated plastic tops shall

be painted with a coat of semigloss enamel paint and sink flanges shall be set in a bed of sealant. Closer and filler strips and finish moldings shall be provided as required. Prior to final acceptance, doors shall be aligned, hardware adjusted, and cabinets left in a clean neat condition.

--End of Section--

## SECTION 12540

### WINDOW BLINDS

#### **PART I. GENERAL**

##### **1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

FEDERAL SPECIFICATIONS (FS)

FS AA-V-00200 (Rev B) Venetian Blinds

NATIONAL FIRE PROTECTION (NFPA)

NFPA 701 (1989) Methods of Fire Test for Flame-Resistant Textiles and Films

##### **1.2 GENERAL**

Horizontal blinds shall be provided as indicated, complete with necessary brackets, fittings, and hardware. Each window covering type utilized shall be a complete unit produced by one manufacturer. Window coverings shall be provided on all exterior windows. Windows to receive a covering shall be completely covered. The Contractor shall take measurements at the building and shall be responsible for the proper fitting and hanging of the equipment. Color shall be as specified in Section 09915 COLOR SCHEDULE.

##### **1.3 DELIVERY AND STORAGE**

The Contractor shall be responsible for the receipt, storage, and handling of materials and supplies necessary to provide a complete installation. Window coverings shall be delivered to the project site in the manufacturer's original unopened containers. Materials shall be stored flat in a clean dry area with temperature maintained above 50 degrees F.

#### **PART 2 PRODUCTS**

##### **2.1 WINDOW BLINDS**

Each blind, including hardware, accessory items, mounting brackets and fastenings, shall be provided as a complete unit produced by one manufacturer. All parts shall be one color and match the color of the blind slat. Steel features shall be treated for corrosion resistance. Paint used on the window blinds shall be lead free.

###### **2.1.1 Horizontal Blinds**

Horizontal blinds shall conform to FS AA-V-00200, Type II 1 inch slats, except as modified below. Blind units shall be capable of nominally 180 degree partial tilting operation and full-height raising. Blinds shall be inside mount.

#### **2.1.1.1 Head Channel and Slats**

Head channel shall be steel not less than 0.024 for Type II. Slats shall be aluminum, not less than 0.0080 inch thick, and of sufficient strength to prevent sag or bow in the finished blind. A sufficient amount of slats shall be provided to assure proper control, uniform spacing, and adequate overlap.

#### **2.1.1.2 Controls**

The slats shall be tilted by a transparent tilting wand, hung vertically by its own weight, and shall swivel for easy operation. The tilter control shall be of enclosed construction. All moving parts and mechanical drive shall be made of compatible materials which do not require lubrication during normal expected life. The tilter shall tilt the slats to any desired angle and hold them at that angle so that any vibration or movement of ladders and slats will not drive the tilter and change the angle of slats. A mechanism shall be included to prevent over tightening. The wand shall be of sufficient length to reach to within 5 feet of the floor.

#### **2.1.1.3 Intermediate Brackets**

Intermediate brackets shall be provided for installation of blinds over 48 inches wide shall be installed as recommended by the manufacturer.

### **PART 3 EXECUTION**

#### **3.1 WINDOW COVERING PLACEMENT SCHEDULE**

Window covering shall be provided at all exterior windows.

#### **3.2 INSTALLATION**

Installation shall be in accordance with the approved detail drawings and manufacturer's installation instructions. Units shall be level, plumb, secure, and at proper height and location relative to window units. The Contractor shall furnish and install supplementary or miscellaneous items in total, including clips, brackets, or anchorages incidental to or necessary for a sound, secure, and complete installation. Installation shall not be initiated until completion of room painting and finishing operations. Upon completion of the installation, window coverings shall be adjusted for form and appearance, in proper operating condition, and free from damage or blemishes. Damaged units shall be repaired or replaced by the Contractor as directed by the Contracting Officer's representative.

--End of Section--

## SECTION 15250

### THERMAL INSULATION FOR MECHANICAL SYSTEMS

#### PART 1 GENERAL

##### 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

##### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167	(1993) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 580	(1993) Stainless and Heat Resisting Steel Wire
ASTM B 209	(1992a) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C 195	(1990) Mineral Thermal Insulating and Cement
ASTM C 449	(1988) Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
ASTM C 533	(1985; R 1990) Calcium Silicate Block and Pipe Thermal Insulation
ASTM C 534	(1994) Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM C 547	(1977; R 1993) Mineral Fiber Preformed Pipe Insulation
ASTM C 552	(1991) Cellular Glass Thermal Insulation
ASTM C 553	(1992) Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 612	(1993) Mineral Fiber Block and Board Thermal Insulation
ASTM C 647	(1989a) Properties and Tests of Mastics and Coating Finishes for Thermal Insulation
ASTM C 920	(1987) Elastomeric Joint Sealants
ASTM C 921	(1989) Determining the Properties of Jacketing Materials for Thermal Insulation
ASTM D 3278	(1989) Test Methods for Flash Point of Liquids by Setaflash Closed-Cup Apparatus
ASTM E 84	(1994) Surface Burning Characteristics of Building Materials
ASTM E 96	(1994) Water Vapor Transmission of Materials

##### FEDERAL SPECIFICATIONS (FS)

FS L-P-535	(Rev E; Notice 2) Plastic Sheet (Sheeting): Plastic Strip: Poly(Vinyl Chloride) and Poly(Vinyl Chloride-Vinyl Acetate), Rigid
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MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS  
INDUSTRY (MSS)

MSS SP-69 (1991) Pipe Hangers and Supports - Selection and Application

MIDWEST INSULATION CONTRACTORS ASSOCIATION (MICA)

MICA-01 (1993) National Commercial & Industrial Insulation Standards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A (1993) Installation of Air Conditioning and Ventilating  
Systems

UNDERWRITERS LABORATORIES (UL)

UL 723 (1993; Rev Apr 1994) Test for Surface Burning  
Characteristics of Building Materials

## **1.2 SYSTEM DESCRIPTION**

Field-applied insulation and accessories on mechanical systems shall be as specified herein; factory-applied insulation is specified under the piping, duct or equipment to be insulated.

## **1.3 GENERAL QUALITY CONTROL**

### **1.3.1 Standard Products**

Materials shall be the standard products of manufacturers regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

### **1.3.2 Installer's Qualifications**

Qualified installers shall have successfully completed three or more similar type jobs within the last 5 years.

### **1.3.3 Surface Burning Characteristics**

Unless otherwise specified, insulation not covered with a jacket shall have a flame spread rating no higher than 75 and a smoke developed rating no higher than 150. The outside surface of insulation systems which are located in air plenums, in ceiling spaces, and in attic spaces shall have a flame spread rating no higher than 25 and a smoke developed rating no higher than 50. Insulation materials located exterior to the building perimeter are not required to be fire-rated. Flame spread and smoke developed ratings shall be determined by ASTM E 84. Insulation shall be tested in the same density and installed thickness as the material that shall be used in the actual construction. Jackets shall comply with the flame spread and smoke developed ratings required by ASTM C 921.

### **1.3.4 Identification of Materials**

Packages or standard containers of insulation, jacket material, cements, adhesives, and coatings delivered for use, and samples required for approval shall have manufacturer's stamp or label attached giving the name of the manufacturer and brand, and a description of the material.

#### **1.4 STORAGE**

Materials shall be delivered in the manufacturer's unopened containers. Materials delivered and placed in storage shall be provided with protection from weather, humidity, dirt, dust and other contaminants by the Contractor. Insulation material and supplies that become dirty, dusty, wet, or otherwise contaminated may be rejected by the Contracting Officer.

### **PART 2 PRODUCTS**

#### **2.1 GENERAL MATERIALS**

Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either the wet or dry state. Materials to be used on stainless steel surfaces shall meet ASTM C 795 requirements. Materials shall be asbestos free and conform to the following:

##### **2.1.1 Adhesives**

###### **2.1.1.1 Acoustical Lining Insulation Adhesive**

Insulation shall be applied in cut-to-size pieces attached to the interior of the duct with a nonflammable, fire-resistant adhesive conforming to ASTM C 916, Type I, NFPA 90A, UL 723, and ASTM E 84. Exposed edges of the liner at the duct ends and at other joints where the lining will be subject to erosion shall be coated with a heavy brush coat of the nonflammable, fire-resistant adhesive to prevent delamination of glass fibers.

###### **2.1.1.2 Mineral Fiber Insulation Cement**

Cement shall be in accordance with ASTM C 195.

###### **2.1.1.3 Contact Adhesive**

Adhesive shall be Type II, Class 1.

###### **2.1.1.4 Lagging Adhesive**

Lagging adhesives shall be nonflammable, fire-resistant in accordance with NFPA 90A, UL 723, and ASTM E 84. Adhesives shall be either the Class 1 or Class 2 type. Class 1 adhesive shall be pigmented red and be suitable for bonding fibrous glass cloth to faced and unfaced fibrous glass insulation board; for bonding cotton brattice cloth to faced and unfaced fibrous glass insulation board; for sealing edges of and bounding fibrous glass tape to joints of fibrous glass board; or for bonding lagging cloth to thermal insulation. Class 2 adhesive shall be pigmented white and be suitable for attaching fibrous glass insulation to metal surfaces. Lagging adhesives shall be applied in strict accordance with the manufacturer's recommendations.

##### **2.1.2 Contact Adhesive**

Adhesive may be dispersed in a nonhalogenated organic solvent with a low flash point (flash point plus or minus 25 degrees F) or, dispersed in a nonflammable organic solvent which shall not have a fire point below 200 degrees F. The adhesive shall not adversely affect, initially or in service, the insulation to which it is applied, nor shall it cause any corrosive effect on metal to which it is applied. Any solvent dispersing medium or volatile component of the adhesive shall have no objectionable odor and shall not contain any

benzene or carbon tetrachloride. The dried adhesive shall not omit nauseous, irritating, or toxic volatile matters or aerosols when the adhesive is heated to any temperature up to 212 degrees F. The adhesive shall be nonflammable, fire resistant conforming to ASTM E 84.

### **2.1.3 Caulking**

ASTM C 920, Type S, Grade NS, Class 25, Use A.

### **2.1.4 Corner Angles**

Nominal 0.016 inch aluminum 1 by 1 inch with factory applied kraft backing. Aluminum shall be ASTM B 209, Alloy 3003, 3105, or 5005.

### **2.1.5 Finishing Cement**

Mineral fiber hydraulic-setting thermal insulating cement ASTM C 449.

### **2.1.6 Glass Tape**

Glass tape shall meet the requirements of UL 723 and ASTM E 84.

#### **2.1.6.1 Plain Weave, Untreated**

The ends shall be properly interlocked with the picks to ensure that there shall be no raveling of the tape edges. It shall have an average weight of 5.8 plus or minus 10 percent ounces per square yard, an average thickness of 0.007 plus or minus 0.001 inches, warp ends/wales of 42 plus or minus 2 per inch or filling picks/courses of 32 plus or minus 2 per inch, a minimum breaking strength of 150 pounds per inch of width, and after heating to 900 degrees F for 2 hours a minimum breaking strength of 40 pounds per inch of width.

#### **2.1.6.2 Knitted, Untreated**

The wales shall be properly interlocked with the courses to ensure that there shall be no raveling of the tape edges. It shall have an average weight of 4.5 plus or minus 10 percent ounces per square yard, an average thickness of 0.007 plus or minus 0.001 inches, warp end/wales 16 plus or minus 2 per inch, a minimum breaking strength of 40 pounds per inch of width, and after heating to 900 degrees F for 2 hours a minimum breaking strength of 21 pounds per inch of width.

#### **2.1.6.3 Distortion Requirements**

There shall be no distortion of the tape when a sample 24 inches in length is spread across a flat horizontal surface and observed for evidence of distortion (such as tendency to curl rather than lie flat). The width tolerance is plus or minus 1/8 inch.

### **2.1.7 Glass Cloth**

Glass cloth shall be an untreated light weight satin weave. It shall be woven with an eight-harness satin weave and shall be fabricated from fibrous glass yarn. The yarn shall be made from low twist continuous filament glass fiber. The maximum average diameter of the glass fibers used for the yarns shall not exceed 0.000299 in. The cloth shall meet the requirements of UL 723 and the following properties.



Average weight	8.9 ounces/square yard
Fabric count warp ends	57 yarns/inch
Filling picks	54 yarns/inch

Minimum breaking strength

Warp	200 lb/inch
Filling	180 lb/inch
After heating to	900 degrees F for 2 hrs
Warp	60 lb/inch
Filling	60 lb/inch

Nominal width of the cloth shall be 3 feet plus or minus 1/2 inch with the following tolerances:

The cloth shall be furnished in 50 plus or minus 5 yard rolls, the minimum length in a spliced roll shall be 4 yards, and a spliced roll shall contain no more than 3 pieces for each 50 yard length.

#### **2.1.8 Staples**

Outward clinching type ASTM A 167, Type 304 or 316 stainless steel.

#### **2.1.9 Jackets**

ASTM C 921, Type I, moisture vapor transmission maximum 0.02 perms, puncture resistance minimum 50 Beach units on all surfaces except concealed ductwork, where a minimum puncture resistance of 25 Beach units is allowable, tensile strength minimum 35 pounds/inch width; Type II, puncture resistance minimum 25 Beach units, tensile strength minimum 20 pound/inch width. Aluminum jackets shall be corrugated, embossed or smooth sheet, 0.016 inch nominal thickness; ASTM B 209, Temper H14, Temper H16, Alloy 3003, 5005, or 3105 with factory applied moisture barrier. Corrugated aluminum jacket shall not be used outdoors. Aluminum jacket securing bands shall be Type 304 stainless steel, 0.015 inch thick, 1/2 inch wide for pipe under 12 inch diameter and 3/4 inch wide for pipe over 12 inch diameter. Aluminum jacket circumferential seam bands shall be 2 by 0.016 inch aluminum matching jacket material. The jacket may, at the option of the Contractor, be provided with a factory fabricated Pittsburgh or "Z" type longitudinal joint. When the "Z" joint is used, the bands at the circumferential joints shall be designed by the manufacturer to seal the joints and hold the jacket in place. Polyvinyl chloride (PVC) jacket and fitting covers shall be FS L-P-535, Composition A, Type II, with minimum thickness 0.030 inch. Insulation under PVC jacket shall meet jacket manufacturer's written recommendations.

#### **2.1.10 Vapor Barrier Coating**

The vapor barrier coating shall be fire and water resistant and appropriately selected for either outdoor or indoor service. Color shall be white. The water vapor permeance of the compound shall not exceed 0.05 perm and shall be determined according to procedure B of ASTM E 96 utilizing apparatus described in ASTM E 96. The coating shall be a nonflammable, fire resistant type conforming to ASTM E 84, NFPA 90A, and UL 723. The flash point of the compound shall not be less than 80 degrees F and shall be determined in accordance with ASTM D 3278. All other application and service properties shall be in accordance with ASTM C 647.

#### **2.1.11 Wire**

Soft annealed ASTM A 580 Type 302, 304 or 316 stainless steel, 16 or 18 gauge.

### **2.2 PIPE INSULATION MATERIALS**

Pipe insulation materials shall be as follows:

#### **2.2.1 Aboveground Cold Pipeline**

Insulation for minus 30 degrees to Plus 60 degrees F shall be as follows:

##### **2.2.1.1 Cellular Glass**

ASTM C 552, Type II, and Type III.

##### **2.2.1.2 Flexible Cellular Insulation**

ASTM C 534, Type I.

##### **2.2.1.3 Mineral Fiber**

ASTM C 547, Class 1 or 2 as required for the operating temperature range.

#### **2.2.2 Aboveground Hot Pipeline**

For aboveground hot pipeline (above 60 degrees F) insulation the following requirements shall be met.

##### **2.2.2.1 Mineral Fiber**

ASTM C 547, Class 1 or Class 2 as required for the operating temperature range.

### **2.3 DUCT INSULATION MATERIALS**

Duct insulation materials shall be as follows:

#### **2.3.1 Rigid Mineral Fiber**

ASTM C 612, Class 1.

#### **2.3.2 Flexible Mineral Fiber**

ASTM C 553, Type I, Class B-2.

#### **2.3.3 Cellular Glass**

ASTM C 552, Type I.

### **2.4 EQUIPMENT INSULATION MATERIALS**

Equipment insulation materials shall be as follows:

#### **2.4.1 Cold Equipment Insulation**

For temperatures below 60 degrees F.

##### **2.4.1.1 Rigid Mineral Fiber**

ASTM C 612, Class 1.

#### **2.4.1.2 Flexible Mineral Fiber**

ASTM C 553, Type I, Class B-4.

#### **2.4.1.3 Cellular Glass**

ASTM C 552, Type I, Type III, or Type IV as required.

#### **2.4.1.4 Flexible Cellular Insulation**

ASTM C 534, Type II.

#### **2.4.2 Hot Equipment Insulation**

For temperatures above 60 degrees F.

##### **2.4.2.1 Rigid Mineral Fiber**

ASTM C 612, Class 2, 3, 4 or 5 as required for temperature encountered to 1800 degrees F.

##### **2.4.2.2 Flexible Mineral Fiber**

ASTM C 553, Type I, Class B-4 to 400 degrees F.

##### **2.4.2.3 Calcium Silicate**

ASTM C 533, Type I, indoors only, or outdoors above 250 degrees F. Pipe shape may be used on diesel engine exhaust piping and mufflers to 1200 degrees F.

##### **2.4.2.4 Cellular Glass**

ASTM C 552, Type I, Type III, or Type IV as required.

##### **2.4.2.5 Flexible Cellular Insulation**

ASTM C 534, Type II to 200 degrees F.

### **PART 3 EXECUTION**

#### **3.1 APPLICATION - GENERAL**

##### **3.1.1 Installation**

Except as otherwise specified, material shall be installed in accordance with the manufacturer's written instructions. Insulation materials shall not be applied until tests specified in other sections of this specification are completed. Material such as rust, scale, dirt and moisture shall be removed from surfaces to receive insulation. Insulation shall be kept clean and dry. Insulation shall not be removed from its shipping containers until the day it is ready to use and shall be returned to like containers or equally protected from dirt and moisture at the end of each workday. Insulation that becomes dirty shall be thoroughly cleaned prior to use. If insulation becomes wet or if aforementioned cleaning does not restore the surfaces to like new condition, the insulation may be rejected, and if rejected, shall be immediately removed from the jobsite. Joints shall be staggered on multilayer insulation. Mineral fiber thermal insulating cement shall be mixed with demineralized water when used on stainless steel surfaces. Insulation, jacketing and accessories shall be installed in accordance with MICA-01 standard plates except where modified herein or on the drawings.

### **3.1.2 Firestopping**

Where pipes and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with firestopping materials as specified in Section 07270 FIRESTOPPING.

### **3.1.3 Painting and Finishing**

Painting shall be as specified in Section 09900 PAINTING, GENERAL.

### **3.1.4 Flexible Cellular Insulation**

Flexible cellular insulation shall be installed with seams and joints sealed with a contact adhesive. Flexible cellular insulation shall not be used on surfaces greater than 200 degrees F. Insulation exposed to weather and not shown to have jacketing shall be protected with two coats of UV resistant finish as recommended by the manufacturer after the adhesive is dry.

### **3.1.5 Welding**

No welding shall be done on piping, duct or equipment without written approval of the Contracting Officer. The capacitor discharge welding process may be used for securing metal fasteners to duct.

## **3.2 PIPE INSULATION INSTALLATION**

### **3.2.1 Pipe Insulation**

#### **3.2.1.1 General**

Pipe insulation shall be continuous and installed on fittings and appurtenances unless specified otherwise. Installation shall be with full length units of insulation and using a single cut piece to complete a run. Cut pieces or scraps abutting each other shall not be used. Pipe insulation shall be omitted on the following:

- a. Interior pipe used solely for fire protection.
- b. Chromium plated pipe to plumbing fixtures. However, fixtures for use by the physically handicapped shall have the hot water supply and drain, including the trap, insulated where exposed.
- c. Sanitary drain lines.
- d. Unions in pipe above 60 degrees F.
- e. Strainers in pipe above 60 degrees F.
- f. Check valves in pipe above 60 degrees F.
- g. Air chambers.

#### **3.2.1.2 Pipes Passing Through Sleeves**

- a. Pipe insulation shall be continuous through the sleeve .
- b. An aluminum jacket with factory applied moisture barrier shall be provided over the insulation wherever penetrations require sealing.
- c. Where penetrating interior walls, the aluminum jacket shall extend 2 inches beyond either side of the wall and shall be secured on each end with a band.

d. Where penetrating floors, the aluminum jacket shall extend from a point below the backup material to a point 10 inches above the floor with one band at the floor and one not more than 1 inch from the end of the aluminum jacket.

e. Where penetrating waterproofed floors, the aluminum jacket shall extend from below the backup material to a point 2 inches above the flashing with a band 1 inch from the end of the aluminum jacket.

f. Where penetrating exterior walls, the aluminum jacket required for pipe exposed to weather shall continue through the sleeve to a point 2 inches beyond the interior surface of the wall.

g. Where penetrating roofs, pipe shall be insulated as required for interior service to a point flush with the top of the flashing and sealed with vapor barrier coating. The insulations for exterior application shall butt tightly to the top of flashing and interior insulation. The exterior aluminum jacket shall extend 2 inches down beyond the end of the insulation to form a counter flashing. The flashing and counter flashing shall be sealed underneath with caulking.

### **3.2.1.3 Pipes Passing Through Hangers**

a. Insulation, whether hot or cold application, shall be continuous through hangers. All horizontal pipes 2 inches and smaller shall be supported on hangers with the addition of a Type 40 protection shield to protect the insulation in accordance with MSS SP-69. Whenever insulation shows signs of being compressed, or when the insulation or jacket shows visible signs of distortion at or near the support shield, insulation inserts as specified below for piping larger than 2 inches shall be installed.

b. Horizontal pipes larger than 2 inches at 60 degrees F and above shall be supported on hangers with the addition of a Type 39 saddle in accordance with MSS SP-69.

c. Horizontal pipes larger than 2 inches below 60 degrees F shall be supported on hangers with the addition of a Type 40 protection shield in accordance with MSS SP-69. An insulation insert of cellular glass or calcium silicate shall be installed above each shield. The insert shall cover not less than the bottom 180 degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 2 inches on each end beyond the protection shield. When insulation inserts are required per the above, and the insulation thickness is less than 1 inch, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the weight of the pipe from crushing the insulation as an option to installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert.

d. Vertical pipes shall be supported with either Type 8 or Type 42 riser clamps with the addition of two Type 40 protection shields in accordance with MSS SP-69 covering the 360 degree arc of the insulation. An insulation insert of cellular glass or calcium silicate shall be installed between each shield and the pipe. The insert shall cover the 360 degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 2 inches on each end beyond the protection shield. When insulation inserts are required per the above, and the insulation thickness is less than 1 inch, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the hanger from crushing the insulation as an option instead of installing

insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert. The vertical weight of the pipe shall be supported with hangers located in a horizontal section of the pipe. When the pipe riser is longer than 30 feet, the weight of the pipe shall be additionally supported hangers in the vertical run of the pipe which are directly clamped to the pipe, penetrating the pipe insulation. These hangers shall be insulated and the insulation jacket sealed as indicated herein for anchors in a similar service.

e. Inserts shall be covered with a jacket material of the same appearance and quality as the adjoining pipe insulation jacket, shall overlap the adjoining pipe jacket 1-1/2 inches, and shall be sealed as required for the pipe jacket. The jacket material used to cover inserts in flexible cellular insulation shall conform to ASTM C 921, Type 1, and is allowed to be of a different material than the adjoining insulation material.

#### **3.2.1.4 Flexible Cellular Pipe Insulation**

Flexible cellular pipe insulation shall be tubular form for pipe sizes 5 inches and less. Sweat fittings shall be insulated with miter-cut pieces the same size as on adjacent piping. Screwed fittings shall be insulated with sleeved fitting covers fabricated from miter-cut pieces and shall be overlapped and sealed to the adjacent pipe insulation.

#### **3.2.2 Aboveground Cold Pipelines**

The following shall be included for aboveground cold pipelines (minus 30 degrees to Plus 60 degrees F):

- a. Domestic cold and chilled drinking water.
- b. Make-up water.
- c. Chilled water.
- d. Dual temperature water, i.e. HVAC hot/chilled water.
- e. Fan coil unit and air handling unit condensate drains.
- f. Exterior above ground standpipe.

#### **3.2.3 Insulation Thickness**

Thickness of insulation shall be as indicated in TABLE I.

TABLE I

Pipe Size (Inches)

Service or Range of Temp (degrees F)	1/4 to 1-1/4	1-1/2 to 3	3-1/2 to 5	6 to 10
Chilled Water (CG)	2	2-1/2	2-1/2	2-1/2
Exterior Dual (CG) Temperature (Provide heat trace with aluminum jacket)	2-1/2	3	3	3
Interior Dual (CG) Temperature	1-1/2	1-1/2	2	2
Domestic (FC) Cold Water	1/2	1/2	1/2	
Condensate Drains (FC) Dual Temperature Runouts (FC)	1/2 1	1/2		
Exterior standpipes (Mineral fiber with aluminum jacket)	1	1	1	1

## NOTES:

CG - Cellular Glass  
 FC - Flexible Cellular  
 MF - Mineral fiber

When runouts to terminal units exceed 6 feet, the entire length of runout shall be insulated like the main feed pipe.

**3.2.3.1 Jacket for Fibrous and Cellular Glass Insulated Pipe**

Insulation shall be covered with a factory applied vapor barrier jacket or field applied seal welded PVC jacket. Insulation inside the building shown to be protected with an aluminum jacket shall have the insulation and vapor barrier jacket installed as specified herein. The aluminum jacket shall be installed as specified for piping exposed to weather, except sealing of the laps of the aluminum jacket is not required.

**3.2.3.2 Insulation for Straight Runs (Fibrous and Cellular Glass)**

- a. Insulation shall be applied to the pipe with joints tightly butted. The ends of fibrous insulation shall be sealed off with vapor barrier coating at intervals not to exceed 15 feet.
- b. Longitudinal laps of the jacket material shall overlap not less than 1-1/2 inches. Butt strips 3 inches wide shall be provided for circumferential joints.
- c. Laps and butt strips shall be secured with adhesive and stapled on 4 inch centers if not factory self-sealing.

d. Factory self-sealing lap systems may be used when the ambient temperature is between 40 degrees F to 120 degrees F during installation. The lap system shall be installed in accordance with manufacturer's recommendations. Stapler shall be used only if specifically recommended by the manufacturer. Where gaps occur, the section shall be replaced or the gap repaired by applying adhesive under the lap and then stapling.

e. All Staples, including those used to repair factory self-seal lap systems, shall be coated with a vapor barrier coating. All seams, except those on factory self-seal systems shall be coated with vapor barrier coating.

f. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and securing it with adhesive, stapling, and coated with vapor barrier coating. The patch shall extend not less than 1-1/2 inches past the break.

g. At penetrations such as thermometers, the voids in the insulation shall be filled and sealed with vapor barrier coating.

#### **3.2.3.3 Insulation for Fittings and Accessories**

a. Pipe insulation shall have ends thoroughly coated with a vapor barrier coating not more than 6 inches from each flange, union, valve, anchor, or fitting in all directions.

b. Insulation may be premolded or segmented. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation should be overlapped 2 inches or one pipe diameter. Loose fill mineral fiber or insulating cement shall be used to fill the voids. Insulation for elbows less than 3 inch size shall be premolded. Insulation for elbows 3 inch size and larger shall be either premolded or segmented. Elbows insulated using segments shall not have less than 3 segments per elbow. Insulation may be secured by wire or tape until finish is applied.

c. Upon completion of installation of insulation on flanges, unions, valves, anchors, fittings and accessories, terminations and insulation not protected by factory vapor barrier jackets or PVC fitting covers shall be protected with two coats of vapor barrier coating with a minimum total thickness of 1/16th inch, applied with glass tape embedded between coats. Tape seams shall overlap 1 inch. The coating shall extend out onto the adjoining pipe insulation 2 inches.

d. Anchors attached directly to the pipe shall be insulated for a sufficient distance to prevent condensation but not less than 6 inches from the insulation surface.

e. Flexible connections at pumps and other equipment shall be insulated with 1/2 inch flexible cellular insulation, unless otherwise indicated.

f. Insulation shall be marked showing the location of unions, strainers, and check valves.

#### **3.2.3.4 Optional PVC Fitting Covers (Interior only)**

At the option of the Contractor, premolded, one or two piece PVC fitting covers may be used in lieu of the vapor barrier and embedded glass tape. Factory premolded insulation segments shall be used under the fitting covers for elbows. Insulation segments shall be the same thickness as adjoining pipe



insulation and the insulation shall be protected with one coat of vapor barrier coating under the PVC cover. The covers shall be secured by PVC vapor barrier tape, adhesive, seal-welding or with tacks made for securing PVC covers. Seams in the cover, and tacks and laps to adjoining pipe insulation jacket, shall be sealed with vapor barrier tape to ensure that the assembly has a continuous vapor seal. Factory or fieldcut blanket insulation shall not be used on pipe below 60 degrees F.

### 3.2.4 Aboveground Hot Pipelines

For hot pipelines above 60 degrees F the following shall be included:

- a. Domestic hot water.
- b. Hot water heating.

#### 3.2.4.1 Insulation Thickness

Insulation thickness shall be determined using the manufacturer's published thermal conductivity k, and the applicable TABLE II or TABLE III. Insulation thickness for pipelines handling 60 degrees F to 200 degrees F domestic hot water shall be as indicated in TABLE IV.

TABLE IV

REQUIRED THICKNESS (IN INCHES) OF PIPE INSULATION  
FOR HANDLING STEAM TO 15 PSIG AND FLUIDS OTHER THAN  
DOMESTIC HOT WATER TO 250 DEGREES F

k = thermal conductivity (average) Btu/hr. sq. ft.  
degree/in. thickness at a mean temperature of 75 degrees F

Thermal conductivity k	Pipe Size, Inches						
	2 or less	2-1/2 to 3	4	5 to 6	8	10	12
0.25	1.5	1.5	2.0	2.0	2.0	2.0	2.5
0.30	1.5	2.0	2.5	2.5	2.5	2.5	3.0
0.35	2.0	2.5	2.5	2.5	3.5	3.5	3.5
0.40	2.5	3.5	3.5	3.0	4.0	4.0	4.0
0.45	3.0	4.0	4.0	3.5	4.5	4.5	4.5

TABLE II

REQUIRED THICKNESS (IN INCHES) OF PIPE INSULATION  
FOR PIPES HANDLING DOMESTIC HOT WATER. MF - MINERAL FIBER  
CG - CELLULAR GLASS FC - FLEXIBLE CELLULAR

Range of Service (degrees F)	Runouts 1/4 to 1-1/2"	Pipe Size, Inches						
		2 or less	2-1/2 to 3	4	5 to 6	8	10	12
61 to 200 (MF)		1.0	1.5	1.5	1.5	1.5	1.5	1.5
(FC)	1/2	1.0	1.5	1.5	1.5			

When runouts to terminal units exceed 12 feet, the entire length of runout shall be insulated like the main feed pipe.

#### **3.2.4.2 Jacket for Insulated Pipe**

Insulation shall be covered with a factory applied Type II jacket or field applied aluminum where required or seal welded PVC.

#### **3.2.4.3 Insulation for Straight Runs**

- a. Insulation shall be applied to the pipe with joints tightly butted.
- b. Longitudinal laps of the jacket material shall overlap not less than 1-1/2 inches, and butt strips 3 inches wide shall be provided for circumferential joints.
- c. Laps and butt strips shall be secured with adhesive and stapled on 4 inch centers if not factory self-sealing. Adhesive may be omitted where pipe is concealed.
- d. Factory self-sealing lap systems may be used when the ambient temperature is between 40 degrees and 120 degrees F and shall be installed in accordance with manufacturer's instructions. Laps and butt strips shall be stapled whenever there is nonadhesion of the system. Where gaps occur, the section shall be replaced or the gap repaired by applying adhesive under the lap and then stapling.
- e. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and be secured with adhesive and stapled on 4 inch centers if not factory self-sealing. Adhesive may be omitted where pipe is concealed. Patch shall extend not less than 1-1/2 inches past the break.

#### **3.2.4.4 Insulation for Fittings and Accessories**

- a. The run of the line pipe insulation shall have the ends brought up to the item.
- b. Insulation of the same thickness and conductivity as the adjoining pipe insulation, either premolded or segmented, shall be placed around the item abutting the adjoining pipe insulation, or if nesting size insulation is used, overlapping 2 inches or one pipe diameter. Loose fill mineral fiber or insulating cement shall be used to fill the voids. Insulation for elbows less than 3 inch size shall be premolded. Insulation for elbows 3 inch size and larger shall be either premolded or segmented. Elbows insulated using segments shall have not less than 3 segments per elbow. Insulation may be wired or taped on until finish is applied.
- c. Upon completion of installation of insulation on flanges, unions, valves, anchors, fittings and accessories, terminations and insulation not protected by factory vapor barrier jackets or PVC fitting covers shall be protected with two coats of Class 1 adhesive applied with glass tape embedded between coats. Tape seams shall overlap 1 inch. Adhesive shall extend onto the adjoining insulation not less than 2 inches. The total dry film thickness shall be not less than 1/16 inch.
- d. Insulation terminations shall be tapered to unions at a 45-degree angle.

e. At the option of the Contractor, factory premolded one- or two-piece PVC fitting covers may be used in lieu of the adhesive and embedded glass tape. Factory premolded segments or factory or field cut blanket insert insulation segments shall be used under the cover and shall be the same thickness as adjoining pipe insulation. The covers shall be secured by PVC vapor barrier tape, adhesive, seal-welding or with tacks made for securing PVC covers.

### **3.2.5 Piping Exposed to Weather**

Piping exposed to weather shall be insulated and jacketed as specified for the applicable service inside the building. After this procedure, an aluminum jacket shall be applied. PVC jacketing requires no factory applied jacket beneath it.

#### **3.2.5.1 Aluminum Jacket**

The jacket shall overlap not less than 2 inches at longitudinal and circumferential joints and shall be secured with bands at not more than 12 inch centers. Longitudinal joints shall be overlapped down to shed water and located at 4 or 8 o'clock positions. Joints on piping 60 degrees F and below shall be sealed with caulking while overlapping to prevent moisture penetration. Where jacketing on piping 60 degrees F and below abuts an uninsulated surface, joints shall be caulked to prevent moisture penetration. Joints on piping above 60 degrees F shall be sealed with a moisture barrier.

#### **3.2.5.2 Insulation for Fittings**

Flanges, unions, valves, fittings, and accessories shall be insulated and finished as specified for the applicable service. Two coats of an emulsion type weatherproof mastic recommended by the insulation manufacturer shall be applied with glass tape embedded between coats. Tape overlaps shall be not less than 1 inch and the adjoining aluminum jacket not less than 2 inches. Factory preformed aluminum jackets may be used in lieu of the above. Molded PVC fitting covers shall be used with PVC lagging and adhesive welded moisture tight.

#### **3.2.5.3 PVC Lagging**

PVC lagging shall be ultraviolet resistant and adhesive welded vapor tight with manufacturer's recommended adhesive. Installation shall include provision for thermal expansion.

### **3.3 DUCT INSULATION INSTALLATION**

Corner angles shall be installed on external corners of insulation on ductwork in exposed finished spaces before covering with jacket. Duct insulation shall be omitted on the following:

- a. Factory fabricated double wall internally insulated duct.
- b. Site-erected air conditioning casings and plenums constructed of factory-insulated sheet metal panels.
- c. Ducts shown to be internally lined with insulation or sound absorbing material, unless indicated otherwise.
- d. Exhaust air ducts unless noted.

### **3.3.1 Insulation and Vapor Barrier for Cold Air Duct**

- a. Supply duct from room fan coil units: 1 inch internal liner and 1 inch exterior duct insulation.
- b. Room fan coil unit return air plenums: 1 inch internal liner.
- c. Supply duct from make-up air units, interior: 2 inch exterior duct insulation.
- d. Supply duct from make-up air units, exterior: Factory fabricated with 2 inch insulation, spiral galvanized inner duct and polyvinyl sulfide coated outer duct.
- e. Exhaust duct from airmen room toilets, interior: 1 inch exterior duct insulation.
- f. Exhaust duct from airmen room toilets, exterior: Factory fabricated with 2 inch insulation, spiral galvanized duct and polyvinyl sulfide coated outer duct.
- g. Exhaust duct from heat exchanger outlet to exhaust fan inlet - no insulation required.

Insulation for rectangular ducts shall be flexible type where concealed, minimum density 3/4 pcf and rigid type where exposed, minimum density 3 pcf. Insulation for round ducts interior to building shall be flexible type, minimum density 3/4 pcf with a factory Type I jacket. Fibrous and cellular glass insulation for exposed ducts shall be provided with either a white, paintable, factory-applied Type I jacket or a vapor barrier jacket coating finish as specified. Fibrous and cellular glass insulation on concealed duct shall be provided with a factory-applied Type I vapor barrier jacket. Vapor barrier coating finish where indicated to be used shall be accomplished by applying two coats of vapor barrier coating with a layer of glass cloth embedded between the coats. The total dry film thickness shall be approximately 1/16 inch. Duct insulation shall be continuous through sleeves and prepared openings except fire wall penetrations. Duct insulation terminating at fire dampers, shall be continuous over the damper collar and retaining angle of fire dampers, which are exposed to unconditioned air and which may be prone to condensate formation. Duct insulation and vapor barrier shall cover the collar, neck, and any uninsulated surfaces of diffusers, registers and grills. Vapor barrier materials shall be applied to form a complete unbroken vapor seal over the insulation.

#### **3.3.1.1 Installation on Concealed Duct**

- a. For rectangular, oval or round ducts, insulation shall be attached by applying Class 2 adhesive around the entire perimeter of the duct in 6 inch wide strips on 12 inch centers.
- b. For rectangular and oval ducts, 24 inches and larger insulation shall be additionally secured to bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 18 inch centers and not more than 18 inches from duct corners.
- c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 18 inch centers and not more than 18 inches from duct corners.

d. Insulation shall be impaled on the mechanical fasteners where used and shall be pressed thoroughly into the adhesive. Care shall be taken to ensure vapor barrier jacket joints overlap 2 inches. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type duct hanger.

e. Self-locking washers shall be installed where mechanical fasteners are used. The pin shall be trimmed back and bent over.

f. Jacket overlaps shall be secured under the overlap with Class 2 adhesive and stapled on 4 inch centers. Staples and seams shall be coated with a brush coat of vapor barrier coating.

g. Breaks in the jacket material shall be covered with patches of the same material as the vapor barrier. The patches shall extend not less than 2 inches beyond the break or penetration in all directions and shall be secured with Class 2 adhesive and staples. Staples and joints shall be sealed with a brush coat of vapor barrier coating.

h. At jacket penetrations such as hangers thermometers and damper operating rods, voids in the insulation shall be filled and the penetration sealed with a brush coat of vapor barrier coating.

i. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor barrier coating finish. The coating shall overlap the adjoining insulation and uninsulated surface 2 inches. Pin puncture coatings shall extend 2 inches from the puncture in all directions.

j. Where insulation standoff brackets occur, insulation shall be extended under the bracket and the jacket terminated at the bracket.

#### **3.3.1.2 Installation on Exposed Duct Work**

a. For rectangular ducts, rigid insulation shall be secured to the duct by mechanical fasteners on all four sides of the duct, spaced not more than 12 inches apart and not more than 3 inches from the edges of the insulation joints. A minimum of two rows of fasteners shall be provided for each side of duct 12 inches and larger. One row shall be provided for each side of duct less than 12 inches.

b. Duct insulation shall be formed with minimum jacket seams. Each piece of rigid insulation shall be fastened to the duct using mechanical fasteners. Insulation shall be brought up to standing seams, reinforcing, and other vertical projections and shall not be carried over. Vapor barrier jacket shall be continuous across seams, reinforcing, and projections. When height of projections is greater than the insulation thickness, insulation and jacket shall be carried over.

c. Insulation shall be impaled on the fasteners; self-locking washers shall be installed and the pin trimmed and bent over.

d. Joints in the insulation jacket shall be sealed with a 4 inch wide strip of the same material as the vapor barrier jacket. The strip shall be secured with Class 2 adhesive and stapled. Staples and seams shall be sealed with a brush coat of vapor barrier coating.

e. Breaks and ribs or standing seam penetrations in the jacket material shall be covered with a patch of the same material as the jacket.

Patches shall extend not less than 2 inches beyond the break or penetration and shall be secured with Class 2 adhesive and stapled. Staples and joints shall be sealed with a brush coat of vapor barrier coating.

f. At jacket penetrations such as hangers, thermometers, and damper operating rods, the voids in the insulation shall be filled and the penetrations sealed with a brush coat of vapor barrier coating.

g. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor barrier coating finish. The coating shall overlap the adjoining insulation and uninsulated surface 2 inches. Pin puncture coatings shall extend 2 inches from the puncture in all directions.

### **3.3.2 Duct Test Holes**

After duct systems have been tested, adjusted, and balanced, breaks in the insulation and jacket shall be repaired in accordance with the applicable section of this specification for the type of duct insulation to be repaired.

### **3.3.3 Duct Exposed to Weather**

#### **3.3.3.1 Installation**

Ducts exposed to weather shall be factory insulated, double wall type. Where field fabricated transition ductwork is required, provide 2-inch rigid insulation with mastic and fab exterior jacket.

## **3.4 EQUIPMENT INSULATION INSTALLATION**

### **3.4.1 General**

Removable insulation sections shall be provided to cover parts of equipment which must be opened periodically for maintenance including vessel covers, fasteners, flanges and accessories. Equipment insulation shall be omitted on the following:

- a. Handholes.
- b. Boiler manholes.
- c. Cleanouts.
- d. ASME stamps.
- e. Manufacturer's nameplates.

### **3.4.2 Insulation for Cold Equipment**

Cold equipment below 60 degrees F: Insulation shall be furnished on equipment handling media below 60 degrees F including the following:

- a. Dual temperature pumps.
- b. Duct mounted coils.
- c. Air handling equipment parts that are not factory insulated.

#### **3.4.2.1 Insulation Type**

Insulation shall be suitable for the temperature encountered. Thicknesses shall be as follows:

- a. Equipment Handling Media Between 35 and 60 degrees F: 1-1/2 inch thick mineral fiber, 2 inch thick cellular glass, or 1-1/2 inch thick flexible cellular.

#### **3.4.2.2 Pump Insulation**

a. Pumps shall be insulated by forming a box around the pump housing. The box shall be constructed by forming the bottom and sides using joints which do not leave raw ends of insulation exposed. Joints between sides and between sides and bottom shall be joined by adhesive with lap strips for rigid mineral fiber and contact adhesive for flexible cellular insulation. The box shall conform to the requirements of MICA-01 plate No. 49 when using flexible cellular insulation. Joints between top cover and sides shall fit tightly forming a female shiplap joint on the side pieces and a male joint on the top cover, thus making the top cover removable.

b. Exposed insulation corners shall be protected with corner angles.

c. Upon completion of installation of the insulation, including removable sections, two coats of vapor barrier coating shall be applied with a layer of glass cloth embedded between the coats. The total dry thickness of the finish shall be 1/16 inch. A parting line shall be provided between the box and the removable sections allowing the removable sections to be removed without disturbing the insulation coating. Caulking shall be applied to parting line, between equipment and removable section insulation, and at all penetrations.

#### **3.4.2.3 Other Equipment**

a. Insulation shall be formed or fabricated to fit the equipment. To ensure a tight fit on round equipment, edges shall be beveled and joints shall be tightly butted and staggered.

b. Insulation shall be secured in place with bands or wires at intervals as recommended by the manufacturer but not more than 12 inch centers except flexible cellular which shall be adhered. Insulation corners shall be protected under wires and bands with suitable corner angles.

c. Cellular glass insulation shall be set in a coating of bedding compound, and joints shall be sealed with bedding compound as recommended by the manufacturer. Mineral fiber insulation joints shall be filled with finishing cement.

d. Insulation on heads of heat exchangers shall be removable. Removable section joints shall be fabricated using a male-female shiplap type joint. The entire surface of the removable section shall be finished by applying two coats of vapor barrier coating with a layer of glass cloth embedded between the coats. The total dry thickness of the finish shall be 1/16 inch.

e. Exposed insulation corners shall be protected with corner angles.

f. Insulation on equipment with ribs shall be applied over 6 by 6 inches by 12 gauge welded wire fabric which has been cinched in place, or if approved by the Contracting Officer, spot welded to the equipment over the ribs. Insulation shall be secured to the fabric with J-hooks and 2 by 2 inches washers or shall be securely banded or wired in place on 12 inch centers.

#### **3.4.2.4 Vapor Barrier**

Upon completion of installation of insulation, penetrations shall be caulked. Two coats of vapor barrier coating shall be applied over insulation, including removable sections, with a layer of glass cloth embedded between the coats. The total dry thickness of the finish shall be 1/16 inch. Caulking shall be applied to parting line between equipment and removable section insulation.

#### **3.4.3 Insulation for Hot Equipment**

Hot equipment above 60 degrees F: Insulation shall be furnished on equipment handling media above 60 degrees F including the following:

- a. Water heaters.
- b. Hot water storage tanks.
- c. Air separation tanks.

##### **3.4.3.1 Insulation**

Insulation shall be suitable for the temperature encountered. Shell and tube-type heat exchangers shall be insulated for the temperature of the shell medium. Insulation thicknesses shall be as follows:

- a. Equipment handling steam to ~15 psig or other media to 250 degrees F: 2 inch thick material.

##### **3.4.3.2 Equipment**

- a. Insulation shall be formed or fabricated to fit the equipment. To ensure a tight fit on round equipment, edges shall be beveled and joints shall be tightly butted and staggered.
- b. Insulation shall be secured in place with bands or wires at intervals as recommended by the manufacturer but not greater than 12 inch centers except flexible cellular which shall be adhered. Insulation corners shall be protected under wires and bands with suitable corner angles.
- c. Cellular glass insulation shall be set in a coating of bedding compound as recommended by the manufacturer, and joints shall be sealed with bedding compound. Mineral fiber joints shall be filled with finishing cement.
- d. Insulation on heads of heat exchangers shall be removable. The removable section joint shall be fabricated using a male-female shiplap type joint. Entire surface of the removable section shall be finished as specified.
- e. Exposed insulation corners shall be protected with corner angles.



f. Upon completion of installation of insulation, penetrations shall be caulked. Two coats of Class I adhesive shall be applied over insulation, including removable sections, with a layer of glass cloth embedded between the coats. The total dry thickness of the finish shall be 1/16 inch. Caulking shall be applied to parting line between equipment and removable section insulation.

#### **3.4.4 Equipment Handling Dual Temperature Media**

Below and above 60 degrees F: Equipment handling dual temperature media shall be insulated as specified for cold equipment.

#### **3.4.5 Equipment Exposed to Weather**

##### **3.4.5.1 Installation**

Equipment exposed to weather shall be insulated and finished in accordance with the requirements for ducts exposed to weather in paragraph DUCT INSULATION INSTALLATION.

##### **3.4.5.2 Optional Panels**

At the option of the Contractor, prefabricated metal insulation panels may be used in lieu of the insulation and finish previously specified. Thermal performance shall be equal to or better than that specified for field applied insulation. Panels shall be the standard catalog product of a manufacturer of metal insulation panels. Fastenings, flashing, and support system shall conform to published recommendations of the manufacturer for weatherproof installation that shall prevent moisture from entering the insulation. Panels shall be designed to accommodate thermal expansion and to support a 250 pound walking load without permanent deformation or permanent damage to the insulation. Exterior metal cover sheet shall be aluminum and exposed fastenings shall be stainless steel or aluminum.

--End of Section--

## SECTION 15330

### WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION

#### PART 1 GENERAL

##### 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

##### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47	(1990) Ferritic Malleable Iron Castings
ASTM A 53	(1993a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 135	(1993) Electric-Resistance-Welded Steel Pipe
ASTM A 183	(1983; R 1990) Carbon Steel Tract Bolts and Nuts
ASTM A 536	(1984; R 1993) Ductile Iron Castings
ASTM A 795	(1993) Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM B 88	(1993a) Seamless Copper Water Tube

##### AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.1	(1989) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.3	(1992) Malleable Iron Threaded Fittings
ASME B16.4	(1992) Cast Iron Threaded Fittings
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1991) Forged Fittings, Socket-Welding and Threaded
ASME B16.18	(1984) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(1989) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B18.2.1	(1981; Supple 1991; R 1992) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(1987; R 1993) Square and Hex Nuts (Inch Series)

##### AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1015	(1993) Double Check Backflow Prevention Assembly
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AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA-01	(1992) Standard Methods for the Examination of Water and Wastewater
AWWA B300	(1992) Hypochlorites
AWWA B301	(1992) Liquid Chlorine
AWWA C104	(1990) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110	(1993) Ductile-Iron and Gray-Iron Fittings, 3 In. through 48 In. (75 mm through 1200 mm), for Water and Other Liquids
AWWA C111	(1990) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151	(1991) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
AWWA C203	(1991) Coal-tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA M20	(1973) Manual: Water Chlorination Principles and Practices

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825	(1994; Supple I, II & III) Approval Guide
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MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-71	(1990) Cast Iron Swing Check Valves, Flanges and Threaded Ends
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13	(1994) Installation of Sprinkler Systems
NFPA 13R	(1994) Installation of Sprinkler Systems in Residential Occupancies Up to and Including Four Stories in Height
NFPA 24	(1992) Installation of Private Fire Service Mains and Their Appurtenances
NFPA 1963	(1993) Fire Hose Connections

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

NICET 1014	(1992) Detail Manual for Certification in the Field of Fire Protection Engineering Technology (Field 003) Automatic Sprinkler System Layout
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UNDERWRITERS LABORATORIES (UL)

UL-01	(1994; Supple) Building Materials Directory
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## **1.2 GENERAL REQUIREMENTS**

Wet pipe sprinkler system shall be provided in all areas of the building. The sprinkler system shall provide fire sprinkler protection for the entire area. Except as modified herein, the system shall be designed and installed in accordance with NFPA 13 and NFPA 13R. Pipe sizes which are not indicated on drawings shall be determined by hydraulic calculation.

### **1.2.1 Hydraulic Design**

The system shall be hydraulically designed to meet the requirements of NFPA 13 and NFPA 13R.

#### **1.2.1.1 Hose Demand**

An allowance for exterior hose streams shall be in accordance with NFPA 13 and NFPA 13R.

#### **1.2.1.2 Basis for Calculations**

The design of the system shall be based upon a water supply as indicated on drawings. Contractor to provide tests to be used as the basis of design. Hydraulic calculations shall be based upon the Hazen-Williams formula with a "C" value of 120 for steel piping, 150 for copper tubing, 140 for new cement-lined ductile-iron piping.

### **1.2.2 Sprinkler Spacing**

Sprinklers shall be uniformly spaced on branch lines. Maximum spacing per sprinkler shall not exceed limits specified in NFPA 13 for light hazard occupancy and NFPA 13R.

## **1.3 HYDRAULIC CALCULATIONS**

Hydraulic calculations shall be as outlined in NFPA 13 except that calculations shall be performed by computer using software specifically designed for fire protection system design. Software which uses k-factors for typical branch lines is not acceptable. Calculations shall be taken back to the water supply source unless water supply data is otherwise indicated. Calculations shall substantiate that the design area indicated is the hydraulically most demanding. Water supply curves and system requirements shall be plotted on semi-logarithmic graph paper so as to present a summary of the complete hydraulic calculation. A summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, actual discharge pressures and actual flows shall be provided. Elevations of hydraulic reference points (nodes) shall be indicated. Documentation shall identify each pipe individually and the nodes connected thereto. The diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient shall be indicated for each pipe. For gridded systems, calculations shall show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. Also for gridded systems, a flow diagram indicating the quantity and direction of flows shall be included. A drawing showing hydraulic reference points (nodes) and pipe designations used in the calculations shall be included and shall be independent of shop drawings.

#### **1.4 SUBMITTAL PREPARER'S QUALIFICATIONS**

The sprinkler system submittals, including as-built drawings, shall be prepared by an individual who is either a registered professional engineer or who is certified as a Level IV Technician by National Institute for Certification in Engineering Technologies (NICET) in the Automatic Sprinkler System Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014.

#### **1.5 INSTALLER QUALIFICATIONS**

The installer shall be experienced and regularly engaged in the installation of the type and complexity of system included in this project. A statement prior to submittal of any other data or drawings, that the proposed sprinkler system installer is regularly engaged in the installation of the type and complexity of system included in this project shall be provided. In addition, data identifying the location of at least three systems recently installed by the proposed installer which are comparable to the system specified shall be submitted. Contractor shall certify that each system has performed satisfactorily, in the manner intended, for a period of not less than 6 months.

#### **1.6 REGULATORY REQUIREMENTS**

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. Applicable material and installation standards referenced in Appendix A of NFPA 13 and NFPA 24 shall be considered mandatory the same as if such referenced standards were specifically listed in this specification. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. All requirements that exceed the minimum requirements of NFPA 13 shall be incorporated into the design. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

#### **1.7 DELIVERY AND STORAGE**

Equipment placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust or other contaminants.

### **PART 2 PRODUCTS**

#### **2.1 GENERAL EQUIPMENT REQUIREMENTS**

##### **2.1.1 Standard Products**

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

##### **2.1.2 Requirements for Fire Protection Service**

Equipment and materials shall have been tested by Underwriters Laboratories, Inc. and listed in UL-04 or approved by Factory Mutual and listed in FM P7825. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL-04 or FM P7825.

### **2.1.3 Nameplates**

Major components of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate permanently affixed to the item of equipment.

## **2.2 UNDERGROUND PIPING SYSTEMS**

### **2.2.1 Pipe**

Piping from a point 6 inches above the floor to the point of connection to the existing water mains shall be ductile iron with a rated working pressure of 150 psi conforming to AWWA C151, with cement mortar lining conforming to AWWA C104.

### **2.2.2 Fittings and Gaskets**

Fittings shall be ductile iron conforming to AWWA C110. Gaskets shall be suitable in design and size for the pipe with which such gaskets are to be used. Gaskets for ductile iron pipe joints shall conform to AWWA C111.

### **2.2.3 Gate Valve and Indicator Posts**

Gate valves for underground installation shall be of the inside screw type with counter-clockwise rotation to open. Where indicating type valves are shown or required, indicating valves shall be gate valves with an approved indicator post of a length to permit the top of the post to be located 3 feet above finished grade. Gate valves and indicator posts shall be listed in UL-04 or FM P7825.

## **2.3 ABOVEGROUND PIPING SYSTEMS**

Aboveground piping shall be steel or copper.

### **2.3.1 Steel Piping System**

#### **2.3.1.1 Steel Pipe**

Except as modified herein, steel pipe shall be black as permitted by NFPA 13 and shall conform to applicable provisions of ASTM A 795, ASTM A 53, or ASTM A 135. Pipe in which threads or grooves are cut shall be Schedule 40. Pipe shall be marked with the name of the manufacturer, kind of pipe, and ASTM designation.

#### **2.3.1.2 Fittings for Non-Grooved Steel Pipe**

Fittings shall be cast iron conforming to ASME B16.4, steel conforming to ASME B16.9 or ASME B16.11, or malleable iron conforming to ASME B16.3. Fittings into which sprinklers, drop nipples or riser nipples (sprigs) are screwed shall be threaded type. Plain-end fittings with mechanical couplings, fittings which use steel gripping devices to bite into the pipe and segmented welded fittings shall not be used.

#### **2.3.1.3 Grooved Mechanical Joints and Fittings**

Joints and fittings shall be designed for not less than 175 psi service and shall be the product of the same manufacturer. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12. Gasket shall be the flush type that

fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A 183 and shall be cadmium plated or zinc electroplated.

#### **2.3.1.4 Flanges**

Flanges shall conform to NFPA 13 and ASME B16.1. Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1/16 inch thick, and full face or self-centering flat ring type. Bolts shall be squarehead conforming to ASME B18.2.1 and nuts shall be hexagon type conforming to ASME B18.2.2.

#### **2.3.2 Copper Tube Systems**

##### **2.3.2.1 Copper Tube**

Copper tube shall conform to ASTM B 88, Types L and M.

##### **2.3.2.2 Copper Fittings**

Cast copper alloy pressure fittings shall conform to ASME B16.18 and wrought copper and bronze pressure fittings shall conform to ASME B16.22.

#### **2.3.3 Pipe Hangers**

Hangers shall be listed in UL-04 or FM P7825 and of the type suitable for the application, construction, and pipe type and sized involved.

#### **2.3.4 Valves**

##### **2.3.4.1 Control Valve and Gate Valve**

Manually operated sprinkler control valve and gate valve shall be outside stem and yoke (OS&Y) type and shall be listed in UL-01 or FM P7825.

##### **2.3.4.2 Check Valve**

Check valve 2 inches and larger shall be listed in UL-01 or FM P7825. Check valves 4 inches and larger shall be of the swing type with flanged cast iron body and flanged inspection plates, shall have a clear waterway and shall meet the requirements of MSS SP-71, for Type 3 or 4.

##### **2.3.4.3 Hose Valve**

Valve shall comply with UL 668 and shall have a minimum rating of 300 psi. Valve shall be non-rising stem, all bronze, 90 degree angle type, with 2-1/2 inch American National Standard Fire Hose Screw Thread (NH) male outlet in accordance with NFPA 1963. Hose valve shall be provided with 2-1/2 inch to 1-1/2 inch reducer. Hose valves shall be equipped with lugged cap with drip drain, cap gasket and chain. Valve finish shall be polished brass.

#### **2.4 ALARM CHECK VALVE ASSEMBLY**

Assembly shall include an alarm check valve, standard trim piping, pressure gauges, bypass, retarding chamber, testing valves, main drain, and other components as required for a fully operational system.

#### **2.5 WATER MOTOR ALARM ASSEMBLY**

Assembly shall include a body housing, impeller or pelton wheel, drive shaft, striker assembly, gong, wall plate and related components necessary for complete operation. Minimum 3/4 inch galvanized piping shall be provided

between the housing and the alarm check valve. Drain piping from the body housing shall be minimum 1 inch galvanized and shall be arranged to drain to the outside of the building. Piping shall be galvanized both on the inside and outside surfaces.

## **2.6 ALARM INITIATING AND SUPERVISORY DEVICES**

### **2.6.1 Sprinkler Waterflow Indicator Switch, Vane Type**

Switch shall be vane type with a pipe saddle and cast aluminum housing. The electro-mechanical device shall include a flexible, low-density polyethylene paddle conforming to the inside diameter of the fire protection pipe. The device shall sense water movements and be capable of detecting a sustained flow of 10 gpm or greater. The device shall contain a retard device adjustable from 0 to 90 seconds to reduce the possibility of false alarms caused by transient flow surges. The switch shall include two SPDT (Form C) contacts, and shall be equipped with a silicone rubber gasket to assure positive water seal and a dustproof cover and gasket to seal the mechanism from dirt and moisture.

### **2.6.2 Valve Supervisory (Tamper) Switch**

Switch shall be suitable for mounting to the type of control valve to be supervised open. The switch shall be tamper resistant and contain one set of SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem.

## **2.7 FIRE DEPARTMENT CONNECTION**

Fire department connection shall be projecting type with cast brass body, matching wall escutcheon lettered "Auto Spkr" or as required to match system with a chromium plated finish. The connection shall have two inlets with individual self-closing clappers, caps with drip drains and chains. Female inlets shall have 2-1/2 inch diameter American National Fire Hose Connection Screw Threads (NH) per NFPA 1963.

## **2.8 SPRINKLERS**

Sprinklers shall be used in accordance with their listed spacing limitations. Temperature classification shall be ordinary. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters shall have temperature classification in accordance with NFPA 13.

### **2.8.1 Upright Sprinkler**

Upright sprinkler shall be brass and shall have a nominal 1/2 inch or 17/32 inch orifice.

### **2.8.2 Pendent Sprinkler**

Pendent sprinkler shall be of the fusible strut or glass bulb type, semi-recessed type with nominal 1/2 inch orifice. Pendent sprinklers shall have a polished chrome or white enamel finish.

### **2.8.3 Sidewall Sprinkler**

Sidewall sprinkler shall have a nominal 1/2 inch orifice. Sidewall sprinkler shall have a polished chrome finish. Sidewall sprinkler shall be the quick-response type.



#### **2.8.4 Residential Sprinkler**

Residential sprinkler shall be the sidewall type with nominal 1/2 inch orifice. Residential sprinkler shall have a polished chrome finish.

#### **2.8.5 Dry Sprinkler Assembly**

Dry sprinkler assembly shall be of the pendent, upright, or sidewall, type as required. Assembly shall include an integral escutcheon. Maximum length shall not exceed maximum indicated in UL-04. Sprinklers shall have a polished chrome finish.

### **2.9 DISINFECTING MATERIALS**

#### **2.9.1 Liquid Chlorine**

Liquid chlorine shall conform to AWWA B301.

#### **2.9.2 Hypochlorites**

Calcium hypochlorite and sodium hypochlorite shall conform to AWWA B300.

### **2.10 ACCESSORIES**

#### **2.10.1 Sprinkler Cabinet**

Spare sprinklers shall be provided in accordance with NFPA 13 and shall be packed in a suitable metal or plastic cabinet. Spare sprinklers shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one wrench of each type required shall be provided.

#### **2.10.2 Pendent Sprinkler Escutcheon**

Escutcheon shall be one-piece metallic type with a depth of less than 3/4 inch and suitable for installation on pendent sprinklers. The escutcheon shall have a factory finish that matches the pendent sprinkler heads.

#### **2.10.3 Pipe Escutcheon**

Escutcheon shall be polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or set screw.

#### **2.10.4 Sprinkler Guard**

Guard shall be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards shall be provided on sprinklers located in mechanical room.

#### **2.10.5 Identification Sign**

Valve identification sign shall be minimum 6 inches wide x 2 inches high with enamel baked finish on minimum 18 gauge steel or 0.024 inch aluminum with red letters on a white background or white letters on red background. Wording of sign shall include, but not be limited to "main drain," "auxiliary drain," "inspector's test," "alarm test," "alarm line," and similar wording as required to identify operational components.

## **2.11 DOUBLE-CHECK VALVE BACKFLOW PREVENTION ASSEMBLY**

Double-check backflow prevention assembly shall comply with ASSE 1015. The assembly shall have a bronze, cast-iron or stainless steel body with flanged ends. The assembly shall include OS&Y shutoff valves on the inlet and outlet, 2-positive-seating check valve for continuous pressure application, and four test cocks. Assemblies shall be rated for working pressure of 150 psi. The maximum pressure loss shall be 6 psi at a flow rate equal to the sprinkler water demand, at the location of the assembly.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION REQUIREMENTS**

The installation shall be in accordance with the applicable provisions of NFPA 13, NFPA 24 and publications referenced therein.

### **3.2 ABOVEGROUND PIPING INSTALLATION**

Piping shall be run straight and bear evenly on hangers and supports.

#### **3.2.1 Piping in Exposed Areas**

Exposed piping shall be installed so as not to diminish exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, shall be installed to provide maximum headroom.

#### **3.2.2 Piping in Finished Areas**

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping shall be concealed above ceilings. Piping shall be inspected, tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas shall be concealed.

#### **3.2.3 Pendent Sprinklers**

Drop nipples to pendent sprinklers shall consist of minimum 1 inch pipe with a reducing coupling into which the sprinkler shall be threaded. Hangers shall be provided on arm-overs to drop nipples supplying pendent sprinklers when the arm-over exceeds 12 inches. Where sprinklers are installed below suspended or dropped ceilings, drop nipples shall be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished space. The outlet of the reducing coupling shall not extend more than 1 inch below the underside of the ceiling. On pendent sprinklers installed below suspended or dropped ceilings, the distance from the sprinkler deflector to the underside of the ceiling shall not exceed 4 inches.

##### **3.2.3.1 Pendent Sprinkler Locations**

Pendent sprinklers in suspended ceilings shall be a minimum of 6 inches from ceiling grid.

#### **3.2.4 Upright Sprinklers**

Riser nipples or "sprigs" to upright sprinklers shall contain no fittings between the branch line tee and the reducing coupling at the sprinkler. Riser nipples exceeding 30 inches in length shall be individually supported.

### **3.2.5 Pipe Joints**

Pipe joints shall conform to NFPA 13, except as modified herein. Not more than four threads shall show after joint is made up. Welded joints will be permitted, only if welding operations are performed as required by NFPA 13 at the Contractor's fabrication shop, not at the project construction site. Flanged joints shall be provided where indicated or required by NFPA 13. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings and fittings shall be from the same manufacturer.

### **3.2.6 Reducers**

Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. The use of grooved-end or rubber-gasketed reducing couplings will not be permitted. When standard fittings of the required size are not manufactured, single bushings of the face type will be permitted. Where used, face bushings shall be installed with the outer face flush with the face of the fitting opening being reduced. Bushings shall not be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 1/2 inch.

### **3.2.7 Pipe Penetrations**

Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core-drilled and provided with pipe sleeves. Each sleeve shall be Schedule 40 galvanized steel, ductile iron or cast iron pipe and shall extend through its respective wall or floor and be cut flush with each wall surface. Sleeves shall provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe shall be firmly packed with mineral wool insulation. Where pipes pass through fire walls, fire partitions, or floors, a fire seal shall be placed between the pipe and sleeve in accordance with Section 07270 FIRESTOPPING. In penetrations which are not fire-rated or not a floor penetration, the space between the sleeve and the pipe shall be sealed at both ends with plastic waterproof cement which will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

### **3.2.8 Escutcheons**

Escutcheons shall be provided for pipe penetration of ceilings and walls. Escutcheons shall be securely fastened to the pipe at surfaces through which piping passes.

### **3.2.9 Inspector's Test Connection**

Unless otherwise indicated, test connection shall consist of 1 inch pipe connected to the remote branch line; a test valve located approximately 7 feet above the floor; a smooth bore brass outlet equivalent to the smallest orifice sprinkler used in the system; and a painted metal identification sign affixed to the valve with the words "Inspector's Test." The discharge orifice shall be located outside the building wall directed so as not to cause damage to adjacent construction or landscaping during full flow discharge.

### **3.2.10 Drains**

Main drain piping shall be provided to discharge at a safe point outside the building. Auxiliary drains shall be provided as required by NFPA 13 except that drain valves shall be used where drain plugs are otherwise permitted.

Where branch lines terminate at low points and form trapped sections, such branch lines shall be manifolded to a common drain line.

#### **3.2.11 Installation of Fire Department Connection**

Connection shall be mounted on the exterior wall approximately 3 feet above finished grade. The piping between the connection and the check valve shall be provided with an automatic drip in accordance with NFPA 13 and arranged to drain to the outside.

#### **3.2.12 Identification Signs**

Signs shall be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by NFPA 13. Hydraulic design data nameplates shall be permanently affixed to each sprinkler riser as specified in NFPA 13.

### **3.3 UNDERGROUND PIPING INSTALLATION**

The fire protection water main shall be laid, and joints anchored, in accordance with NFPA 24. The supply line shall terminate inside the building with a flanged piece, the bottom of which shall be set not less than 6 inches above the finished floor. A blind flange shall be installed temporarily on top of the flanged piece to prevent the entrance of foreign matter into the supply line. A concrete thrust block shall be provided at the elbow where the pipe turns up toward the floor. In addition, joints shall be anchored in accordance with NFPA 24 using pipe clamps and steel rods from the elbow to the flange above the floor and from the elbow to a pipe clamp in the horizontal run of pipe. Buried steel components shall be provided with a corrosion protective coating in accordance with AWWA C203.

### **3.4 EARTHWORK**

Earthwork shall be performed in accordance with applicable provisions of Section 02221 EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS.

### **3.5 ELECTRICAL WORK**

Alarm signal wiring connected to the building fire alarm control system shall be in accordance with Section 16721 FIRE DETECTION AND ALARM SYSTEM. Wiring color code shall remain uniform throughout the system.

### **3.6 STERILIZATION**

After system components have been installed and pressure tested, each portion of the completed system shall be sterilized. After pressure tests have been made, the portion to be sterilized shall be thoroughly flushed with water until all entrained dirt and other foreign materials have been removed before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material shall be fed into the sprinkler piping at a constant rate of 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or liquid chlorine injected into the system through a solution-fed chlorinator and booster pump, shall be used. Chlorination application shall continue until the entire system is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system shall be opened and closed several times to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. The system shall be then flushed with clean water until the residual chlorine is reduced to less than one part per million. Samples of water in properly sterilized containers for bacterial examination will be

taken from several system locations which are approved by the Contracting Officer. Samples shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA-01. The testing method shall be either the multiple-tube fermentation technique or the membrane-filter technique. The sterilization shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

### **3.7 FIELD PAINTING AND FINISHING**

Field painting and finishing are specified in Section 09900 PAINTING, GENERAL.

### **3.8 PRELIMINARY TESTS**

The system, including the underground water mains, and the aboveground piping and system components, shall be tested to assure that equipment and components function as intended. The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure shall be tested in accordance with NFPA 13 and NFPA 24. Upon completion of specified tests, the Contractor shall complete certificates as specified in paragraph SUBMITTALS.

#### **3.8.1 Underground Piping**

##### **3.8.1.1 Flushing**

Underground piping shall be flushed in accordance with NFPA 24. This includes the requirement to flush the lead-in connection to the fire protection system at a flow rate not less than the calculated maximum water demand rate of the system.

##### **3.8.1.2 Hydrostatic Testing**

New underground piping shall be hydrostatically tested in accordance with NFPA 24. The allowable leakage shall be measured at the specified test pressure by pumping from a calibrated container. The amount of leakage at the joints shall not exceed 2 quarts per hour per 100 gaskets or joints, regardless of pipe diameter.

#### **3.8.2 Aboveground Piping**

##### **3.8.2.1 Hydrostatic Testing**

Aboveground piping shall be hydrostatically tested in accordance with NFPA 13 at not less than 200 psi or 50 psi in excess of maximum system operating pressure and shall maintain that pressure without loss for 2 hours. There shall be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

##### **3.8.3 Testing of Alarm Devices**

Each alarm switch shall be tested by flowing water through the inspector's test connection. Each water-operated alarm devices shall be tested to verify proper operation.

#### **3.8.4 Main Drain Flow Test**

Following flushing of the underground piping, a main drain test shall be made to verify the adequacy of the water supply. Static and residual pressures shall be recorded on the certificate specified in paragraph SUBMITTALS. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.

#### **3.9 FINAL ACCEPTANCE TEST**

A technician employed by the installing Contractor shall be present for the final tests and shall provide a complete demonstration of the operation of the system. This shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches. After operation of control valves has been completed, the main drain test shall be repeated to assure that control valves are in the open position. In addition, the representative shall have available copies of as-built drawings and certificates of tests previously conducted. The installation shall not be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received.

--End of Section--

## SECTION 15400

### PLUMBING, GENERAL PURPOSE

#### PART 1 GENERAL

##### 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

##### AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI SAMA Z236.1	(1983) General Purpose Lab for Liquid-in-Glass Thermometers - General Purpose Laboratory Use
ANSI Z21.10.3	(1993; Z21.10.3) Gas Water Heaters Vol. III Storage, with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous Water Heaters
ANSI Z21.22	(1986; Z21.22a) Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems
ANSI Z21.56	(1991; Z21.56a; Z21.56b) Gas-Fired Pool Heaters

##### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47	(1990) Ferritic Malleable Iron Castings
ASTM A 53	(1993a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 74	(1994) Cast Iron Soil Pipe and Fittings
ASTM A 105	(1994) Forgings, Carbon Steel, for Piping Components
ASTM A 183	(1983; R 1990) Carbon Steel Track Bolts and Nuts
ASTM A 193	(1994b) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 515	(1992) Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
ASTM A 516	(1990) Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A 536	(1984; R 1993) Ductile Iron Castings
ASTM A 888	(1994) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
ASTM B 32	(1993) Solder Metal
ASTM B 42	(1993) Seamless Copper Pipe, Standard Sizes
ASTM B 43	(1991) Seamless Red Brass Pipe, Standard Sizes

ASTM B 75	(1993) Seamless Copper Tube
ASTM B 88	(1993a) Seamless Copper Water Tube
ASTM B 152	(1993a) Copper Sheet, Strip, Plate, and Rolled Bar
ASTM B 306	(1992) Copper Drainage Tube (DWV)
ASTM B 370	(1992) Copper Sheet and Strip for Building Construction
ASTM B 584	(1993b) Copper Alloy Sand Castings for General Applications
ASTM B 641	(1993) Seamless and Welded Copper Distribution Tube (Type D)
ASTM B 813	(1993) Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
ASTM C 564	(1993) Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM D 2000	(1990) Rubber Products in Automotive Applications
ASTM D 2564	(1993) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2661	(1994a) Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D 2665	(1994) Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D 2822	(1991) Asphalt Roof Cement
ASTM D 2855	(1993) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 3139	(1989) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3212	(1992) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3308	(1991a) PTFE Resin Skived Tape
ASTM D 3311	(1992) Drain, Waste, and Vent (DWV) Plastic Fittings Patterns
ASTM F 409	(1993) Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings
ASTM F 477	(1993) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 628	(1993) Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core
ASTM F 891	(1993a) Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe with a Cellular Core



AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING  
ENGINEERS (ASHRAE)

ASHRAE 90.1 (1989; 90.1b; 90.1c; 90.1d; 90.1e; 90.1g; 90.1i)  
Energy Efficient Design of New Buildings Except  
Low-Rise Residential Buildings

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A112.1.2 (1991) Air Gaps in Plumbing Systems

ASME A112.14.1 (1975; R 1990) Backwater Valves

ASME A112.18.1M (1994; Errata Feb 1995) Plumbing Fixture Fittings

ASME A112.21.1M (1991) Floor Drains

ASME A112.36.2M (1991) Cleanouts

ASME B1.20.1 (1983; R 1992) Pipe Threads, General Purpose (Inch)

ASME B16.3 (1992) Malleable Iron Threaded Fittings

ASME B16.4 (1992) Cast Iron Threaded Fittings

ASME B16.5 (1988; Errata Oct 88; B16.5a) Pipe Flanges and Flanged  
Fittings

ASME B16.12 (1991) Cast Iron Threaded Drainage Fittings

ASME B16.15 (1985) Cast Bronze Threaded Fittings Classes 125 and  
250

ASME B16.18 (1984) Cast Copper Alloy Solder Joint Pressure  
Fittings

ASME B16.21 (1992) Nonmetallic Flat Gaskets for Pipe Flanges

ASME B16.22 (1989) Wrought Copper and Copper Alloy Solder Joint  
Pressure Fittings

ASME B16.23 (1992; Errata Jan 1994) Cast Copper Alloy Solder Joint  
Drainage Fittings - DWV

ASME B16.24 (1991; Errata Jun 91) Cast Copper Alloy Pipe Flanges,  
Class 150, 300, 400, 600, 900, 1500 and 2500, and  
Flanged Fittings, Class 150 and 300

ASME B16.29 (1986) Wrought Copper and Wrought Copper Alloy Solder  
Joint Drainage Fittings - DWV

ASME B31.5 (1992; B31.5a) Refrigeration Piping

ASME B40.1 (1991) Gauges - Pressure Indicating Dial Type -  
Elastic Element

ASME CSD-1 (1992; CSD-1a; CSD-1b) Controls and Safety Devices for  
Automatically Fired Boilers

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1001 (1990) Pipe Applied Atmospheric Type Vacuum Breakers  
ASSE 1003 (1981) Water Pressure Reducing Valves for Domestic  
Water Supply Systems  
ASSE 1005 (1993) Water Heater Drain Valves - 3/4-Inch Iron Pipe  
Size  
ASSE 1012 (1993) Backflow Preventers with Intermediate  
Atmospheric Vent  
ASSE 1013 (1993) Reduced Pressure Principle Backflow Preventers  
ASSE 1018 (1986) Trap Seal Primer Valves Water Supply Fed  
ASSE 1037 (1990) Pressurized Flushing Devices (Flushometers) for  
Plumbing Fixtures/F

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B300 (1992) Hypochlorites  
AWWA B301 (1992) Liquid Chlorine  
AWWA C105 (1988) Polyethylene Encasement for Ductile-Iron Piping  
for Water and Other Liquids  
AWWA C203 (1991) Coal-Tar Protective Coatings and Linings for  
Steel Water Pipelines - Enamel and Tape - Hot-Applied  
AWWA C606 (1987) Grooved and Shouldered Joints  
AWWA M20 (1973) Manual: Water Chlorination Principles and  
Practices

AMERICAN WELDING SOCIETY (AWS)

AWS B2.2 (1991) Brazing Procedure and Performance Qualification

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI HSN (1985) Neoprene Rubber Gaskets for Hub and Spigot Cast  
Iron Soil Pipe and Fittings

CODE OF FEDERAL REGULATIONS (CFR)

10 CFR 430 Energy Conservation Program for Consumer Products

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-238 (Rev B) Seat, Water Closet  
CID A-A-240 (Basic) Shower Head, Ball Joint

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA 404/O-RR (1992) Copper Tube for Plumbing, Heating, Air  
Conditioning and Refrigeration

FEDERAL SPECIFICATIONS (FS)

FS QQ-B-654	(Rev A; Am 1; Notice 1) Brazing Alloys, Silver
FS TT-P-1536	(Rev A) Plumbing Fixture Setting Compound
FS WW-C-440	(Rev B; Am 2) Clamps, Hose, (Low-Pressure)
FS WW-P-541/GEN	(Rev E; Am 1) Plumbing Fixtures
FS WW-P-541/4	(Rev B; Am 1) Plumbing Fixtures (Lavatories)
FS WW-P-541/5	(Rev B; Am 1) Plumbing Fixtures (Sinks, Kitchen, Service, and Laundry Trays)
FS WW-V-35	(Rev C) Valve, Ball

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH  
(FCCHR)

FCCHR-01	(1993) Manual of Cross-Connection Control
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HYDRAULIC INSTITUTE (HI)

HI-01	(1983) Standards for Centrifugal, Rotary & Reciprocating Pumps
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MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS  
INDUSTRY (MSS)

MSS SP-25	(1993) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-67	(1990) Butterfly Valves
MSS SP-69	(1991) Pipe Hangers and Supports - Selection and Application
MSS SP-70	(1990) Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(1990) Cast Iron Swing Check Valves, Flanges and Threaded Ends
MSS SP-72	(1992) Ball Valves with Flanged or Butt-welding Ends for General Service
MSS SP-73	(1991) Brazing Joints for Copper and Copper Alloy Pressure Fittings
MSS SP-78	(1987; R 1992) Cast Iron Plug Valves, Flanged and Threaded Ends
MSS SP-80	(1987) Bronze Gate, Globe, Angle and Check Valves
MSS SP-84	(1990) Valves - Socket Welding and Threaded Ends
MSS SP-85	(1994) Cast Iron Globe & Angle Valves Flanged and Threaded Ends

NATIONAL ASSOCIATION OF PLUMBING-HEATING-COOLING CONTRACTORS  
(NAPHCC)

NAPHCC-01 (1993; Supple 1994) National Standard Plumbing Code  
(Non-Illustrated Edition)

NAPHCC-02 (1993) National Standard Plumbing Code Illustrated  
Edition

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54 (1988) National Fuel Gas Code

NFPA 90A (1989) Installation of Air Conditioning and  
Ventilating Systems

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

PPFA-01 (1991) Plastic Pipe in Fire Resistive Construction

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI WH 201 (1992) Water Hammer Arresters

## **1.2 STANDARD PRODUCTS**

Specified materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products. Specified equipment shall essentially duplicate equipment that has performed satisfactorily at least two years prior to bid opening.

## **1.3 PERFORMANCE REQUIREMENTS**

### **1.3.1 Welding**

Welding of plumbing piping will not be allowed.

## **1.4 ELECTRICAL WORK**

Motors, motor controllers and motor efficiencies shall conform to the requirements of Section 16415 ELECTRICAL WORK, INTERIOR. Electrical motor-driven equipment specified herein shall be provided complete with motors. Equipment shall be rated at 60 Hz, single phase, ac unless otherwise indicated. Where a motor controller is not provided in a motor-control center on the electrical drawings, a motor controller shall be as indicated. Motor controllers shall be provided complete with properly sized thermal-overload protection in each ungrounded conductor, auxiliary contact, and other equipment, at the specified capacity, and including an allowable service factor.

## **1.5 REGULATORY REQUIREMENTS**

### **1.5.1 Plumbing**

Plumbing work shall be in accordance with NAPHCC-01, unless otherwise stated and installed in accordance with NAPHCC-02.

## **1.6 PROJECT/SITE CONDITIONS**

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

Materials for various services shall be in accordance with TABLES I and II. Pipe schedules shall be selected based on service requirements. Pipe fittings shall be compatible with the applicable pipe materials. Plastic pipe, fittings, and solvent cement shall meet NSF Std 14 and shall be NSF listed for the service intended. Plastic pipe and fittings shall not be used for potable hot and cold water service. Pipe threads (except dry seal) shall conform to ASME B1.20.1. Grooved pipe couplings and fittings shall be from the same manufacturer. Material or equipment containing lead shall not be used in any potable water system. Hubless cast-iron soil pipe shall not be installed under concrete floor slabs. Plastic pipe shall not be installed under concrete floor slabs, or in air plenums.

#### **2.1.1 Pipe Joint Materials**

Grooved pipe shall not be used under ground. Joints and gasket materials shall conform to the following:

- a. Coupling for Cast-Iron Pipe: ASTM A 74, AWWA C606.
- b. Coupling for Steel Pipe: AWWA C606.
- c. Couplings for Grooved Pipe: Ductile Iron ASTM A 536 (Grade 65-45-12). Copper ASTM A 536.
- d. Flange Gaskets: Gaskets shall be made of non-asbestos material in accordance with ASME B16.21. Gaskets shall be flat, 1/16 inch thick, and contain Aramid fibers bonded with Styrene Butadiene Rubber (SBR) or Nitro Butadiene Rubber (NBR). Gaskets shall be the full face or self centering flat ring type. Gaskets used for hydrocarbon service shall be bonded with NBR.
- e. Neoprene Gaskets for Hub and Cast-Iron Pipe and Fittings: CISPI HSN.
- f. Brazing Material: Brazing material shall conform to AWS A5.8, BCuP-5.
- g. Brazing Flux: Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have a 100 percent flushable residue; contain slightly acidic reagents; contain potassium borides; and contain fluorides. Silver brazing materials shall be in accordance with FS QQ-B-654.
- h. Solder Material: Solder metal shall conform to ASTM B 32 95-5 tin-antimony.
- i. Solder Flux: Flux shall be liquid form, non-corrosive, and conform to ASTM B 813, Standard Test 1.
- j. PTFE Tape: PTFE Tape, for use with Threaded Metal or Plastic Pipe, ASTM D 3308.

- k. Rubber Gaskets for Cast-Iron Soil-Pipe and Fittings: ASTM C 564.
- l. Rubber Gaskets for Grooved Pipe: ASTM D 2000, maximum temperature 230 degrees F.
- m. Flexible Elastomeric Seals: ASTM D 3139, ASTM D 3212 or ASTM F 477.
- n. Bolts and Nuts for Grooved Pipe Couplings: Heat-treated carbon steel, ASTM A 183.
- q. Plastic Solvent Cement for PVC Plastic Pipe: ASTM D 2564 and ASTM D 2855.
- r. Flanged fittings including flanges, bolts, nuts, bolt patterns, etc. shall be in accordance with ASME B16.5 class 150 and shall have the manufacturer's trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A 105. Blind flange material shall conform to ASTM A 516 cold service and ASTM A 515 for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A 193.

### **2.1.2 Miscellaneous Materials**

Miscellaneous materials shall conform to the following:

- a. Water Hammer Arrestor: PDI WH 201.
- b. Copper, Sheet and Strip for Building Construction: ASTM B 370.
- c. Asphalt Roof Cement: ASTM D 2822.
- d. Hose Clamps: FS WW-C-440.
- e. Supports for Off-The-Floor Plumbing Fixtures: ASME A112.6.1M.
- f. Metallic Cleanouts: ASME A112.36.2M.
- g. Plumbing Fixture Setting Compound: FS TT-P-1536, Type II.
- h. Coal-Tar Protective Coatings and Linings for Steel Water Pipelines: AWWA C203.
- i. Hypochlorites: AWWA B300.
- j. Liquid Chlorine: AWWA B301.
- k. Polyethylene Encasement for Ductile-Iron Piping: AWWA C105.
- l. Gauges - Pressure and Vacuum Indicating Dial Type - Elastic Element: ASME B40.1.
- m. Thermometers: ANSI SAMA Z236.1 .

### **2.1.3 Pipe Insulation Material**

Insulation shall be as specified in Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

## **2.2 PIPE HANGERS, INSERTS, AND SUPPORTS**

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

### 2.3 VALVES

Valves shall be provided on supplies to equipment and fixtures. Valves 2-1/2 inches and smaller shall be bronze with threaded bodies for pipe and solder-type connections for tubing. Valves 3 inches and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Grooved end valves may be provided if the manufacturer certifies that the valves meet the performance requirements of applicable MSS standard. Valves shall conform to the following standards:

Description	Standard
Butterfly Valves	MSS SP-67
Cast-Iron Gate Valves, Flanged and Threaded Ends	MSS SP-70
Cast-Iron Swing Check Valves, Flanged and Threaded Ends	MSS SP-71
Ball Valves with Flanged Butt-Welding Ends for General Service	MSS SP-72
Ball Valves	FS WW-V-35
Cast-Iron Plug Valves, Flanged and Threaded Ends	MSS SP-78
Bronze Gate, Globe, Angle, and Check Valves	MSS SP-80
Steel Valves, Socket Welding and Threaded Ends	MSS SP-84
Cast-Iron Globe and Angle Valves, Flanged and Threaded Ends	MSS SP-85
Backwater Valves	ASME A112.14.1
Vacuum Relief Valves	ASSE 1001
Water Pressure Reducing Valves	ASSE 1003
Water Heater Drain Valves	ASSE 1005
Trap Seal Primer Valves	ASSE 1018
Temperature and Pressure Relief Valves for Hot Water Supply Systems	ANSI Z21.22
Temperature and Pressure Relief Valves for Automatically Fired Hot Water Boilers	ASME CSD-1 Safety Code No., Part CW, Article 5

#### 2.3.1 Backwater Valves

Backwater valves shall be either separate from the floor drain or a combination floor drain, P-trap, and backwater valve, as shown. Valves shall have cast-iron bodies with cleanouts large enough to permit removal of interior parts. Valves shall be of the flap type, hinged or pivoted, with revolving disks. Hinge pivots, disks, and seats shall be nonferrous metal. Disks shall be slightly open in a no-flow no-backwater condition. Cleanouts shall extend to finished floor and be fitted with threaded countersunk plugs.

### **2.3.2 Wall Faucets**

Wall faucets with vacuum-breaker backflow preventer shall be brass with 3/4 inch male inlet threads, hexagon shoulder, and 3/4 inch hose connection. Faucet handle shall be securely attached to stem.

### **2.3.3 Relief Valves**

Water heaters and hot water storage tanks shall have a combination pressure and temperature (P&T) relief valve. The pressure relief element of a P&T relief valve shall have adequate capacity to prevent excessive pressure buildup in the system when the system is operating at the maximum rate of heat input. The temperature element of a P&T relief valve shall have a relieving capacity which is at least equal to the total input of the heaters when operating at their maximum capacity. Relief valves shall be rated according to ANSI Z21.22. Relief valves for systems where the maximum rate of heat input is less than 200,000 Btuh shall have 3/4 inch minimum inlets, and 3/4 inch outlets. Relief valves for systems where the maximum rate of heat input is greater than 200,000 Btuh shall have 1 inch minimum inlets, and 1 inch outlets. The discharge pipe from the relief valve shall be the size of the valve outlet.

## **2.4 FIXTURES**

Fixtures shall be water conservation type, in accordance with NAPHCC-01. Vitreous china, nonabsorbent, hard-burned, and vitrified throughout the body shall be provided. Porcelain enameled ware shall have specially selected, clear white, acid-resisting enamel coating evenly applied on surfaces. No fixture will be accepted that shows cracks, crazes, blisters, thin spots, or other flaws. Fixtures shall be equipped with appurtenances such as traps, faucets, stop valves, and drain fittings. Each fixture and piece of equipment requiring connections to the drainage system shall be equipped with a trap. Brass expansion or toggle bolts capped with acorn nuts shall be provided for supports, and polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Fixtures with the supply discharge below the rim shall be equipped with backflow preventers. Internal parts of flush and/or flushometer valves, shower mixing valves, shower head face plates, pop-up stoppers of lavatory waste drains, and pop-up stoppers and overflow tees and shoes of bathtub waste drains may contain acetal resin, fluorocarbon, nylon, acrylonitrile-butadiene-styrene (ABS) or other plastic material, if the material has provided satisfactory service under actual commercial or industrial operating conditions for not less than 2 years. Plastic in contact with hot water shall be suitable for 180 degrees F water temperature. Plumbing fixtures shall generally be in accordance with FS WW-P-541/GEN, and shall be as indicated in paragraph PLUMBING FIXTURE SCHEDULE.

### **2.4.1 Lavatories**

Wall hung vitreous china lavatories shall be provided with two integral molded lugs on the back-underside of the fixture and drilled for bolting to the wall in a manner similar to the hanger plate.

## **2.5 BACKFLOW PREVENTERS**

Reduced pressure principle assemblies, double check valve assemblies, atmospheric (nonpressure) type vacuum breakers, and pressure type vacuum breakers shall be tested, approved, and listed in accordance with FCCHR-01. Backflow preventers with intermediate atmospheric vent shall conform to ASSE 1012. Reduced pressure principle backflow preventers shall conform to ASSE 1013. Hose connection vacuum breakers shall conform to ASSE 1011. Pipe applied atmospheric type vacuum breakers shall conform to ASSE 1001. Air gaps in plumbing systems shall conform to ASME A112.1.2.



## **2.6 DRAINS**

### **2.6.1 Floor and Shower Drains**

Floor and shower drains shall consist of a galvanized body, integral seepage pan, and adjustable perforated or slotted chromium-plated bronze, nickel-bronze, or nickel-brass strainer, consisting of grate and threaded collar. Floor drains shall be cast iron except where metallic waterproofing membrane is installed. Drains shall be of double drainage pattern for embedding in the floor construction. The seepage pan shall have weep holes or channels for drainage to the drainpipe. The strainer shall be adjustable to floor thickness. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or waterproofing membrane shall be provided when required. Drains shall be provided with threaded or caulked connection. In lieu of a caulked joint between the drain outlet and waste pipe, a neoprene rubber gasket conforming to ASTM C 564 may be installed, provided that the drain is specifically designed for the rubber gasket compression type joint. Floor and shower drains shall conform to ASME A112.21.1M.

### **2.6.2 Boiler Room Drains**

Boiler room drains shall have combined drain and trap, hinged grate, removable bucket, and threaded brass cleanout with brass backwater valve. The removable galvanized cast-iron sediment bucket shall have rounded corners to eliminate fouling and shall be equipped with hand grips. Drain shall have a minimum water seal of 4 inches. The grate area shall be not less than 100 square inches.

## **2.7 TRAPS**

Unless otherwise specified, traps shall be plastic per ASTM F 409 or copper-alloy adjustable tube type with slip joint inlet and swivel. Traps shall be without a cleanout. Tubes shall be copper alloy with walls not less than 0.032 inch thick within commercial tolerances, except on the outside of bends where the thickness may be reduced slightly in manufacture by usual commercial methods. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level. Swivel joints shall be below the discharge level and shall be of metal-to-metal or metal-to-plastic type as required for the application. Nuts shall have flats for wrench grip. Outlets shall have internal pipe thread, except that when required for the application, the outlets shall have sockets for solder-joint connections. The depth of the water seal shall be not less than 2 inches. The interior diameter shall be not more than 1/8 inch over or under the nominal size, and interior surfaces shall be reasonably smooth throughout. A copper alloy "P" trap assembly consisting of an adjustable "P" trap and threaded trap wall nipple with cast brass wall flange shall be provided for lavatories. The assembly shall be a standard manufactured unit and may have a rubber-gasketed swivel joint.

## **2.8 WATER HEATER**

Water heater types and capacities shall be as indicated. Capacity shall be determined by the Contractor. Water heater to be gas fired type. The thermal efficiencies and stand by heat losses shall conform to TABLE III as determined by ASHRAE 90.1 for each type of water heater specified. The only exception is that the storage capacity need not meet the standard loss requirement if the tank surface area is not insulated to R-12.5 and if a standing light is not used.

### **2.8.1 Automatic Storage Type**

Heaters shall be complete with control system, temperature gauge, and pressure gauge, and shall have ASME rated combination pressure and temperature relief valve.

### **2.8.2 Gas-Fired Type**

Gas-fired water heaters shall conform to ANSI Z21.10.3.

## **2.9 HOT-WATER STORAGE TANKS**

Hot-water storage tanks shall be constructed by one manufacturer, ASME stamped for the working pressure, and shall have the National Board (ASME) registration. Tanks to be glass lined suitable for storage of domestic hot water. Each tank shall be equipped with a thermometer, conforming to ANSI SAMA Z236.1, Type I, Class 3, Range C, style and form as required for the installation, and with 7 inch scale. Thermometer shall have a separable socket suitable for a 3/4 inch tapped opening. Tanks shall be equipped with pressure gauge. Insulation shall be as specified in Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

## **2.10 PUMPS**

### **2.10.1 Circulating Pumps**

Domestic hot water circulating pumps shall be electrically driven, single-stage, centrifugal, with mechanical seals, suitable for the intended service. Pump capacities, efficiencies, motor sizes, speeds, and impeller types shall be determined by the Contractor. Pump and motor shall be close-coupled with an overhung impeller, or supported by the piping on which it is installed. The shaft shall be one-piece, heat-treated, corrosion-resisting steel with impeller and smooth-surfaced housing of bronze. Motor shall be totally enclosed, fan-cooled and shall have sufficient horsepower for the service required. Pump shall conform to HI-01. Each pump motor shall be equipped with an across-the-line magnetic controller in a NEMA 250, Type 1 enclosure with "START-STOP" switch in cover. Pump motors smaller than Fractional horsepower pump motors shall have integral thermal overload protection in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Guards shall shield exposed moving parts.

## **PART 3 EXECUTION**

### **3.1 GENERAL INSTALLATION REQUIREMENTS**

Neither hubless cast-iron nor plastic pipe shall be installed under concrete floor slabs. Piping located in air plenums shall conform to NFPA 90A requirements. Unprotected plastic pipe shall not be installed in air plenum. Installation of plastic pipe where in compliance with NFPA may be installed in accordance with PPFA-01. The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be extended to connect to the existing services as indicated. A gate valve and drain shall be installed on the water service line inside the building approximately 6 inches above the floor from point of entry. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. Exterior underground utilities shall be at least 12 inches below the finish grade. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means. Valves shall be installed with control no lower than the valve body.

### **3.1.1 Water Pipe, Fittings, and Connections**

#### **3.1.1.1 Utilities**

The piping shall be extended to fixtures, outlets, and equipment. The hot-water and cold-water piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shutoff valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, hydrants, shower heads, and flushing devices shall be anchored to prevent movement.

#### **3.1.1.2 Cutting and Repairing**

The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

#### **3.1.1.3 Protection of Fixtures, Materials, and Equipment**

Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.

#### **3.1.1.4 Mains, Branches, and Runouts**

Piping shall be installed as indicated or required. Pipe shall be accurately cut and worked into place without springing or forcing. Structural portions of the building shall not be weakened. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Branch pipes from service lines may be taken from top, bottom, or side of main, using crossover fittings required by structural or installation conditions. Supply pipes, valves, and fittings shall be kept a sufficient distance from other work and other services to permit not less than 1/2 inch between finished covering on the different services. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Water pipe shall not be buried in or under floors. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted except for use in situations in which standard factory fabricated components are furnished to accommodate specific excepted installation practice. Change in direction shall be made with fittings, except that bending of 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

#### **3.1.1.5 Pipe Drains**

Pipe drains indicated shall consist of 3/4 inch hose bibb with renewable seat and ball valve ahead of hose bibb. At other low points, 3/4 inch brass plugs or caps shall be provided. Disconnection of the supply piping at the fixture is an acceptable drain.

#### **3.1.1.6 Expansion and Contraction of Piping**

Allowance shall be made throughout for expansion and contraction of water pipe. Each hot-water and hot-water circulation riser shall have expansion

loops or other provisions such as offsets, changes in direction, etc., as required. Risers shall be securely anchored as required to force expansion to loops. Branch connections from risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Horizontal runs of pipe over 50 feet in length shall be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining. If mechanical grooved pipe coupling systems are provided, the deviation from design requirements for expansion and contraction may be allowed pending approval of Contracting Officer.

#### **3.1.1.7 Commercial-Type Water Hammer Arresters**

Commercial-type water hammer arresters shall be provided on hot- and cold-water supplies and shall be located to comply with PDI WH 201 requirements, with precise location and sizing to be in accordance with PDI WH 201. Water hammer arresters, where concealed, shall be accessible by means of access doors or removable panels. Commercial-type water hammer arresters shall conform to PDI WH 201. Vertical capped pipe columns will not be permitted.

#### **3.1.2 Joints**

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints shall be made up with fittings of compatible material and made for the specific purpose intended.

##### **3.1.2.1 Threaded**

Threaded joints shall have American Standard taper pipe threads conforming to ASME B1.20.1. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied.

##### **3.1.2.2 Mechanical Couplings**

Grooved mechanical joints shall be prepared according to the coupling manufacturer's instructions. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, or narrow-land micrometer. Groove width and dimension of groove from end of the pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations.

##### **3.1.2.3 Union and Flanged**

Unions, flanges and mechanical couplings shall not be concealed in walls, ceilings, or partitions. Unions shall be used on pipe sizes 2-1/2 inches and smaller; flanges shall be used on pipe sizes 3 inches and larger.

##### **3.1.2.4 Cast Iron Soil, Waste and Vent Pipe**

Bell and spigot compression and hubless gasketed clamp joints for soil, waste and vent piping shall be installed per the manufacturer's recommendations.

#### **3.1.2.5 Copper Tube and Pipe**

The tube or fittings shall not be annealed when making connections. Connections shall be made with a multiflame torch.

a. Brazed. Brazed joints shall be made in conformance with AWS B2.2, MSS SP-73, and CDA 404/O-RR with flux and are acceptable for line sizes.

Copper to copper joints shall include the use of copper-phosphorus or copper-phosphorus-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorus, copper-phosphorus-silver or a silver brazing filler metal.

b. Soldered. Soldered joints shall be made with flux and are only acceptable for lines 2 inches and smaller. Soldered joints shall conform to ASME B31.5 and CDA 404/O-RR.

c. Copper Tube Extracted Joint. An extracted mechanical joint may be made in copper tube. Joint shall be produced with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, dimpled depth stops shall be provided. Branch tube shall be notched for proper penetration into fitting to ensure a free flow joint. Extracted joints shall be brazed in accordance with NAPHCC-01 using B-Cup series filler metal in accordance with MSS SP-73. Soldered extracted joints will not be permitted.

#### **3.1.2.6 Plastic Pipe**

PVC pipe shall have joints made with solvent cement or mated flanged.

#### **3.1.3 Dissimilar Pipe Materials**

Connections between ferrous and non-ferrous copper pipe shall be made with dielectric unions or flange waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

#### **3.1.4 Pipe Sleeves and Flashing**

Pipe sleeves shall be furnished and set in their proper and permanent location.

##### **3.1.4.1 Sleeve Requirements**

Pipes passing through concrete or masonry walls or concrete floors shall be provided with pipe sleeves. Sleeves are not required for cast-iron soil pipe passing through concrete slab on grade. Sleeves shall not be installed in structural members, except where approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical equipment rooms, lavatories, kitchens, and other plumbing fixture areas shall extend a minimum of 4 inches above the finished floor. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance between bare pipe and inside of sleeve or between jacket over insulation and sleeves. Sleeves in bearing walls shall be steel pipe or cast-iron pipe. Sleeves for membrane waterproof floors shall be steel pipe, cast-iron pipe, or plastic pipe. Membrane clamping devices shall be provided on pipe sleeves for waterproof floors. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with

lock-type longitudinal seam, or moisture-resistant fiber or plastic. Plastic sleeves shall not be used in nonbearing fire walls, roofs, or floor/ceilings. Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed as indicated with sealants conforming to ASTM C 920 and with a primer, backstop material and surface preparation as specified in Section 07920 JOINT SEALING. The annular space between pipe and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated.

#### **3.1.4.2 Flashing Requirements**

Pipes passing through roof waterproofing membrane shall be installed through a 16 ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 8 inches from the pipe and shall be set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 10 inches. For cleanouts, the flashing shall be turned down into the hub and caulked after placing the ferrule. Flashing for dry vents shall be turned down into the pipe to form a waterproof joint. Pipes, up to and including 10 inches in diameter, passing through roof or floor waterproofing membrane may be installed through a cast-iron sleeve with caulking recess, anchor lugs, flashing-clamp device, and pressure ring with brass bolts. Flashing shield shall be fitted into the sleeve clamping device. Pipes passing through wall waterproofing membrane shall be sleeved as described above. A waterproofing clamping flange shall be installed.

#### **3.1.4.3 Optional Counterflashing**

Instead of turning the flashing down into a dry vent pipe, or caulking and sealing the annular space between the pipe and flashing or metal-jacket-covered insulation and flashing, counterflashing may be accomplished by utilizing the following:

- a. A standard roof coupling for threaded pipe up to 6 inches in diameter.
- b. A tack-welded or banded-metal rain shield around the pipe.

#### **3.1.5 Fire Seal**

Where pipes pass through fire walls, fire-partitions, fire-rated pipe chase walls or floors above grade, a fire seal shall be provided as specified in Section 07270 FIRESTOPPING.

#### **3.1.6 Supports**

##### **3.1.6.1 General**

Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run.

### 3.1.6.2 Pipe Hangers, Inserts, and Supports

Installation of pipe hangers, inserts and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein.

- a. Types 5, 12, and 26 shall not be used.
- b. Type 3 shall not be used on insulated pipe.
- c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for type 18 inserts.
- d. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and shall have both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.
- e. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.
- f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.
- g. Type 39 saddles shall be used on insulated pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher. Type 39 saddles shall be welded to the pipe.
- h. Type 40 shields shall:
  - (1) Be used on insulated pipe less than 4 inches.
  - (2) Be used on insulated pipe 4 inches and larger when the temperature of the medium is 60 degrees F or less.
  - (3) Have a high density insert for pipe 2 inches and larger and for smaller pipe sizes when the insulation is suspected of being visibly compressed, or distorted at or near the shield/insulation interface. High density inserts shall have a density of 8 pcf or greater.
- i. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves. Operating temperatures in determining hanger spacing for PVC or CPVC pipe shall be 120 degrees F for PVC. Horizontal pipe runs shall include allowances for expansion and contraction.
- j. Vertical pipe shall be supported at each floor, except at slab-on-grade, at intervals of not more than 15 feet nor more than 8 feet from end of risers, and at vent terminations. Vertical pipe risers shall include allowances for expansion and contraction.
- k. Type 40 shields used on insulated pipe shall have high density inserts with a density of 8 pcf or greater.
- l. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided to allow longitudinal pipe movement. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered. Lateral restraints shall be provided as needed. Where steel slides do not require provisions for lateral restraint the following may be used:

(1) On pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher, a Type 39 saddle, welded to the pipe, may freely rest on a steel plate.

(2) On pipe less than 4 inches a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

(3) On pipe 4 inches and larger carrying medium less than 60 degrees F a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

m. Pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation. The insulation shall be continuous through the hanger on all pipe sizes and applications.

n. Where there are high system temperatures and welding to piping is not desirable, the type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 4 inches or by an amount adequate for the insulation, whichever is greater.

o. Hangers and supports for plastic pipe shall not compress, distort, cut or abrade the piping, and shall allow free movement of pipe except where otherwise required in the control of expansion/contraction.

### **3.1.7 Pipe Cleanouts**

Pipe cleanouts shall be the same size as the pipe except that cleanout plugs larger than 4 inches will not be required. A cleanout installed in connection with cast-iron soil pipe shall consist of a long-sweep 1/4 bend or one or two 1/8 bends. An extra-heavy cast-brass or cast-iron ferrule with countersunk cast-brass head screw plug shall be caulked into the hub of the fitting and shall be flush with the floor. Cleanouts in connection with other pipe shall be T-pattern, 90-degree branch drainage fittings with cast-brass screw plugs, except plastic plugs shall be installed in plastic pipe. Plugs shall be the same size as the pipe up to and including 4 inches. Cleanout tee branches with screw plug shall be installed at the foot of soil and waste stacks, at the foot of interior downspouts, on each connection to building storm drain where interior downspouts are indicated, and on each building drain outside the building. Cleanouts on pipe concealed in partitions shall be provided with chromium plated bronze, nickel bronze, nickel brass or stainless steel flush type access cover plates. Round access covers shall be provided and secured to plugs with securing screw. Square access covers may be provided with matching frames, anchoring lugs and cover screws. Cleanouts in finished walls shall have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic shall be provided with a chrome-plated cast brass, nickel brass, or nickel bronze cover secured to the plug or cover frame and set flush with the finished floor. Heads of fastening screws shall not project above the cover surface. Where cleanouts are provided with adjustable heads, the heads shall be cast iron.

## **3.2 WATER HEATERS AND HOT WATER STORAGE TANKS**

### **3.2.1 Relief Valves**

No valves shall be installed between a relief valve and its water heater or storage tank. The P&T relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the relief valve shall be installed directly in a tapping in the tank or heater; otherwise, the P&T valve shall be installed in the hot-water outlet piping. A vacuum relief valve shall be provided on the cold water



supply line to the hot-water storage tank or water heater and mounted above and within 6 inches above the top of the tank or water heater.

### **3.2.2 Installation of Gas-Fired Water Heater**

Installation shall conform to NFPA 54 for gas fired. Storage water heaters that are not equipped with integral heat traps and having vertical pipe risers shall be installed with heat traps directly on both the inlet and outlet. Circulating systems need not have heat traps installed. An acceptable heat trap may be a piping arrangement such as elbows connected so that the inlet and outlet piping make vertically upward runs of not less than 24 inches just before turning downward or directly horizontal into the water heater's inlet and outlet fittings. Commercially available heat traps, specifically designed by the manufacturer for the purpose of effectively restricting the natural tendency of hot water to rise through vertical inlet and outlet piping during standby periods may also be approved.

### **3.2.3 Heat Traps**

Piping to and from each water heater and hot water storage tank shall be routed horizontally and downward a minimum of 2 feet before turning in an upward direction.

### **3.2.4 Connections to Water Heaters**

Connections of metallic pipe to water heaters shall be made with dielectric unions or flanges.

## **3.3 FIXTURES AND FIXTURE TRIMMINGS**

Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield, and loose-key pattern stops for supplies with threaded, sweat or solvent weld inlets shall be furnished and installed with fixtures. Where connections between copper tubing and faucets are made by rubber compression fittings, a beading tool shall be used to mechanically deform the tubing above the compression fitting. Exposed traps and supply pipes for fixtures and equipment shall be connected to the rough piping systems at the wall, unless otherwise specified under the item. Floor and wall escutcheons shall be as specified. Drain lines and hot water lines of fixtures for handicapped personnel shall be insulated and do not require polished chrome finish. Plumbing fixtures and accessories shall be installed within the space shown.

### **3.3.1 Fixture Connections**

Where space limitations prohibit standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings shall be provided. Connections between earthenware fixtures and flanges on soil pipe shall be made gastight and watertight with a closet-setting compound or neoprene gasket and seal. Use of natural rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.

### **3.3.2 Flushometer Valves**

Flushometer valves shall be secured to prevent movement by anchoring the long finished top spud connecting tube to wall adjacent to valve with approved metal bracket. Flushometer valves for water closets shall be installed 39 inches above the floor.

### **3.3.3 Shower Bath Outfits**

The area around the water supply piping to the mixing valves and behind the escutcheon plate shall be made watertight by caulking or gasketing.

### **3.3.4 Fixture Supports**

Fixture supports for off-the-floor lavatories, urinals, water closets, and other fixtures of similar size, design, and use, shall be of the chair-carrier type. The carrier shall provide the necessary means of mounting the fixture, with a foot or feet to anchor the assembly to the floor slab. Adjustability shall be provided to locate the fixture at the desired height and in proper relation to the wall. Support plates, in lieu of chair carrier, shall be fastened to the wall structure only where it is not possible to anchor a floor-mounted chair carrier to the floor slab.

#### **3.3.4.1 Support for Solid Masonry Construction**

Chair carrier shall be anchored to the floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be imbedded in the masonry wall.

#### **3.3.4.2 Support for Cellular-Masonry Wall Construction**

Chair carrier shall be anchored to floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be fastened to the cellular wall using through bolts and a back-up plate.

#### **3.3.4.3 Support for Steel Stud Frame Partitions**

Chair carrier shall be used. The anchor feet and tubular uprights shall be of the heavy duty design; and feet (bases) shall be steel and welded to a square or rectangular steel tube upright. Wall plates, in lieu of floor-anchored chair carriers, shall be used only if adjoining steel partition studs are suitably reinforced to support a wall plate bolted to these studs.

#### **3.3.4.4 Support for Wood Stud Construction**

Where floor is a concrete slab, a floor-anchored chair carrier shall be used. Where entire construction is wood, wood crosspieces shall be installed. Fixture hanger plates, supports, brackets, or mounting lugs shall be fastened with not less than No. 10 wood screws, 1/4 inch thick minimum steel hanger, or toggle bolts with nut. The wood crosspieces shall extend the full width of the fixture and shall be securely supported.

### **3.3.5 Backflow Prevention Devices**

Plumbing fixtures, equipment, and pipe connections shall not cross connect or interconnect between a potable water supply and any source of nonpotable water. The backflow prevention device shall be installed where indicated and located so that no part of the device will be submerged. Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit.

### **3.3.6 Access Panels**

Access panels shall be provided for concealed valves and controls, or any item requiring inspection or maintenance. Access panels shall be of sufficient

size and located so that the concealed items may be serviced, maintained, or replaced. Access panels shall be as specified in Section 05500 MISCELLANEOUS METAL.

### **3.3.7 Sight Drains**

Sight drains shall be installed so that the indirect waste will terminate 2 inches above the flood rim of the funnel to provide an acceptable air gap.

### **3.3.8 Traps**

Each trap shall be placed as near the fixture as possible, and no fixture shall be double-trapped. Traps installed on cast-iron soil pipe shall be cast iron. Traps installed on steel pipe or copper tubing shall be recess-drainage pattern, or brass-tube type. Traps installed on plastic pipe may be plastic conforming to ASTM D 3311. Traps for acid-resisting waste shall be of the same material as the pipe.

## **3.4 IDENTIFICATION SYSTEMS**

### **3.4.1 Identification Tags**

Identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and valve number shall be installed on valves, except those valves installed on supplies at plumbing fixtures. Tags shall be 1-3/8 inch minimum diameter, and marking shall be stamped or engraved. Indentations shall be black, for reading clarity. Tags shall be attached to valves with No. 12 AWG, copper wire, chrome-plated beaded chain, or plastic straps designed for that purpose.

### **3.4.2 Color Coding**

Color coding for piping identification shall be as specified in Section 09900 PAINTING, GENERAL.

### **3.4.3 Color Coding Scheme for Locating Hidden Utility Components**

Scheme shall be provided in buildings having suspended grid ceilings. The color coding scheme shall identify points of access for maintenance and operation of operable components which are not visible from the finished space and installed in the space directly above the suspended grid ceiling. The operable components shall include valves, dampers, switches, linkages and thermostats. The color coding scheme shall consist of a color code board and colored metal disks. Each colored metal disk shall be approximately 3/8 inch in diameter and secured to removable ceiling panels with fasteners. The fasteners shall be inserted into the ceiling panels so that the fasteners will be concealed from view. The fasteners shall be manually removable without tools and shall not separate from the ceiling panels when panels are dropped from ceiling height. Installation of colored metal disks shall follow completion of the finished surface on which the disks are to be fastened. The color code board shall have the approximate dimensions of 3 foot width, 30 inches height, and 1/2 inch thickness. The board shall be made of wood fiberboard and framed under glass or 1/16 inch transparent plastic cover. Unless otherwise directed, the color code symbols shall be approximately 3/4 inch in diameter and the related lettering in 1/2 inch high capital letters. The color code board shall be mounted and located in the mechanical or equipment room.

## **3.5 ESCUTCHEONS**

Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in

boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

### **3.6 PAINTING**

Painting of pipes, hangers, supports, and other iron work, either in concealed spaces or exposed spaces, is specified in Section 09900 PAINTING, GENERAL.

### **3.7 TESTS, FLUSHING, AND STERILIZATION**

#### **3.7.1 Plumbing System**

The plumbing system shall be tested in accordance with NAPHCC-01.

##### **3.7.1.1 Shower Pans**

After installation of the pan and finished floor, the drain shall be temporarily plugged below the weep holes. The floor area shall be flooded with water to a minimum depth of 1 inch for a period of 24 hours. Any drop in the water level during test, except for evaporation, will be reason for rejection, repair, and retest.

##### **3.7.2 Defective Work**

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. Caulking of screwed joints or holes will not be permitted.

##### **3.7.3 System Flushing**

After tests are completed, potable water piping shall be flushed. In general, sufficient water shall be used to produce a minimum water velocity of 2.5 feet per second through piping being flushed. Flushing shall be continued until discharge water shows no discoloration. System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced in line. After flushing and cleaning, systems shall be prepared for service by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor. When the work is complete, the hot-water system shall be adjusted for uniform circulation. Flushing devices and automatic control systems shall be adjusted for proper operation.

##### **3.7.4 Operational Test**

Upon completion of and prior to acceptance of the installation, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each plumbing system of each building sector (A, B, D and E) and shall include the following information in a report with conclusion as to the adequacy of the system:

- a. Time, date, and duration of test.
- b. Water pressures at the most remote and the highest fixtures.
- c. Operation of each fixture and fixture trim.

- d. Operation of each valve, hydrant, and faucet.
- e. Temperature of each domestic hot-water supply.
- f. Operation of each floor drain by flooding with water.
- g. Operation of each vacuum breaker and backflow preventer.

### **3.7.5 Sterilization**

After pressure tests have been made, the entire domestic hot- and cold-water distribution system shall be sterilized. System shall be thoroughly flushed with water of sufficient velocity until all entrained dirt and other foreign material have been removed, before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the main with a hypochlorinator, or liquid chlorine injected into the main through a solution-feed chlorinator and booster pump, shall be used. The chlorine residual shall be checked at intervals to ensure that the proper level is maintained. Chlorine application shall continue until the entire main is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system being sterilized shall be opened and closed several times during the contact period to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. Water tanks shall be disinfected by the addition of chlorine directly to the filling water. Following a 6 hour period, no less than 50 ppm chlorine residual shall remain in the tank. The system including the tanks shall then be flushed with clean water until the residual chlorine is reduced to less than one part per million. During the flushing period each valve and faucet shall be opened and closed several times. From several points in the system the Contracting Officer will take samples of water in properly sterilized containers for bacterial examination. The samples of water shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA-01. The testing method used shall be either the multiple-tube fermentation technique or the membrane-filter technique. The sterilizing shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

### **3.8 PLUMBING FIXTURE SCHEDULE**

#### **P-1 WATER CLOSET:**

Siphon-jet, elongated bowl, top supply spud, ASME A112.19.2M, floor mounted. Floor flange shall be copper alloy, cast iron, or plastic.

Gasket shall be wax type.

Seat - CID A-A-238, Type A, white plastic, elongated, open front.

Flushometer Valve - ASSE 1037, large diaphragm type with non-hold-open feature, backcheck angle control stop, and vacuum breaker. Minimum upper chamber inside diameter of not less than 2-5/8 inches at the point where the diaphragm is sealed between the upper and lower chambers. The maximum water use shall be 1.6 gallons per flush.

P-2 Shower: Shower heads, CID A-A-240, shall include a non-removable, tamperproof device to limit shower flow to 2.75 gpm when tested in accordance with ASME A112.18.1M.

Wall Mounted: Shower head shall be nonadjustable spray, stainless steel or chromium plated brass with ball joint. Handles shall be chrome-plated die cast zinc alloy. Control valves shall be copper alloy and have metal integral parts of copper alloy, nickel alloy, or stainless steel. Valves shall be pressure balanced type. Shower head shall be vandalproof with integral back.

P-3 LAVATORY:

Manufacturer's standard sink depth, FS WW-P-541/4, vitreous china, countertop, oval.

Faucet - Faucets shall be center set type. Faucets shall have metal replaceable cartridge control unit or metal cartridge units with diaphragm which can be replaced without special tools. Valves and handles shall be copper alloy. Connection between valve and spout for center-set faucet shall be of rigid metal tubing. The flow shall be limited to 2.5 gpm at a flowing pressure of 80 psi.

Handles - Lever type. Cast, formed, or drop forged copper alloy.

Drain - Pop-up drain shall include stopper, lift rods, jam nut, washer, and tail piece. See paragraph FIXTURES for optional plastic accessories.

P-4 KITCHEN SINK:

FS WW-P-541/5, ledge back with holes for faucet and spout single bowl 24 by 30 inches stainless steel.

Faucet and Spout - Cast or wrought copper alloy. Aerator shall have internal threads. The flow shall be limited to 2.5 gpm at a flowing water pressure of 80 psi.

Handle - Cast copper alloy, wrought copper alloy, or stainless steel. Single lever type.

Drain Assembly - Plug, cup strainer, crossbars, jam nuts, washers, couplings, stopper, etc. shall be copper alloy or stainless steel.

### **3.9 POSTED INSTRUCTIONS**

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

### **3.10 PERFORMANCE OF WATER HEATING EQUIPMENT**

Standard rating condition terms are as follows:

EF = Energy factor, overall efficiency.

ET = Thermal efficiency with 70 degrees F delta T.

EC = Combustion efficiency, 100 percent - flue loss when smoke = 0 (trace is permitted).

SL = Standby loss in W/sq. ft. based on 80 degrees F delta T, or in percent per hour based on nominal 90 degrees F delta T.

HL = Heat loss of tank surface area.

V = Storage volume in gallons

### 3.10.1 Storage Water Heaters

#### 3.10.1.1 Gas

a. Storage capacity of 100 gallons or less, and input rating of 75,000 Btu/h or less: minimum EF shall be 0.62-0.0019V per 10 CFR 430.

b. Storage capacity of more than 100 gallons - or input rating more than 75,000 Btu/h: EF shall be 77 percent; maximum SL shall be  $1.3+38/V$ , per ANSI Z21.10.3.

#### 3.10.2 Unfired Hot Water Storage

Volumes and inputs: maximum HL shall be 6.5 Btu/h/sq. ft.

TABLE  
PIPE AND FITTING MATERIALS FOR  
DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

		SERVICE					
Item No.	Pipe and Fitting Materials	A	B	C	D	E	F
1	Cast iron soil pipe and fittings, hub and spigot, ASTM A 74 with compression gaskets	X	X	X	X	X	
2	Cast iron pipe and fittings hubless, CISPI 301 and ASTM A 888	X	X	X	X		
3	Cast iron drainage fittings, threaded, ASME B16.12 for use with Item 10	X			X	X	
4	Cast iron screwed fittings (threaded) ASME B16.4 for use with Item 10				X	X	
5	Grooved pipe couplings, ferrous and non-ferrous pipe ASTM A 536 and ASTM A 47	X	X		X	X	

6	Ductile iron grooved joint fittings for ferrous pipe ASTM A 536 and ASTM A 47 for use with Item 5	X	X		X	X
7	Bronze sand casting grooved joint pressure fittings for non-ferrous pipe ASTM B 584, for use with Item 5	X	X		X	X
8	Wrought copper grooved joint pressure fittings for non-ferrous pipe ASTM B 75 C12200, ASTM B 152 C11000, ASME B16.22 ASME B16.22 for use with Item 5	X	X			
9	Malleable-iron threaded fittings, galvanized ASME B16.3 for use with Item 10				X	X
10	Steel pipe, seamless galvanized, ASTM A 53, Type S, Grade B	X			X	X
11	Seamless red brass pipe, ASTM B 43			X	X	
12	Bronzed flanged fittings, ASME B16.24 for use with Items 11 and 14				X	X
13	Cast copper alloy solder joint pressure fittings, ASME B16.18 for use with Item 14				X	X
14	Seamless copper pipe, ASTM B 42				X	X
15	Cast bronze threaded fittings, ASME B16.15				X	X
16	Copper drainage tube, (DWV), ASTM B 306	X	X	X	X	X
17	Wrought copper and wrought alloy solder-joint drainage fittings. ASME B16.29	X	X	X	X	X
18	Cast copper alloy solder joint drainage fittings, DWV, ASME B16.23	X	X	X	X	X
19	Acrylonitrile-Butadiene-Styrene (ABS) plastic drain, waste, and vent pipe and fittings ASTM D 2661, ASTM F 628	X	X	X	X	X
20	Polyvinyl Chloride plastic drain, waste and vent pipe and fittings, ASTM D 2665, ASTM F 891, (Sch 40)	X	X	X	X	X



SERVICE:

- A - Underground Building Soil, Waste and Storm Drain
- B - Aboveground Soil, Waste, Drain In Buildings
- C - Underground Vent
- D - Aboveground Vent
- E - Interior Rainwater Conductors Aboveground
- F - Corrosive Waste And Vent Above And Belowground
- Hard Temper

TABLE I

PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEM

		SERVICE			
Item No.	Pipe and Fitting Materials	A	B	C	D
1	Bronze flanged fittings, ASME B16.24 for use with Items 4 and 6	X	X		X
2	Seamless copper pipe, ASTM B 42	X	X		X
3	Seamless copper water tube, ASTM B 88	X	X	X	
4	Seamless and welded copper distribution tube (Type D) ASTM B 641	X	X	X	X
5	Cast bronze threaded fittings, ASME B16.15 for use with Items 7 and 8	X	X		X
6	Wrought copper and bronze solder-joint pressure fittings, ASME B16.22	X	X	X	X
7	Cast copper alloy solder-joint pressure fittings, ASME B16.18	X	X	X	X
8	Unions: brass or bronze, FS WW-U-516	X	X		

A - Cold Water Aboveground

B - Hot Water 80 degrees F Maximum Aboveground

Indicated types are minimum wall thicknesses.

- Type L - Hard

- Type K - Hard temper with brazed joints only or type K-soft temper without joints in or under floors

- In or under slab floors only brazed joints

TABLE II

## STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE RATINGS FOR WATER HEATING EQUIPMENT

## A. STORAGE WATER HEATERS

FUEL PERFORMANCE	STORAGE CAPACITY LITERS		INPUT RATING	TEST PROCEDURE	MINIMUM
-----	-----		-----	-----	-----
Elect.	120 max.		12 kW max.	10 CFR 430	EF = 0.95-0.00132V minimum
Elect.	120 min.	OR	12 kW min.	ASHRAE 90.1 (Addenda B)	SL = 1.9 W/sq. ft. maximum
Gas	100 max.		75,000 Btu/h maximum	10 CFR 430	EF = 0.62-0.0019V minimum
Gas	100 - OR - - minimum -		75,000 Btu/h	ANSI Z21.10.3	ET = 77 percent; SL = 1.3+38/V max.
Oil	190 max.		105,000 Btu/h	10 CFR 430	EF = 0.59-0.0019V minimum
Oil	190 -OR - - minimum -		105,000 Btu/h	10 CFR 430	EC = 83 percent; SL = 1.3+38/V maximum

## B. Unfired Hot Water Storage

Volumes and inputs: maximum HL shall be 6.5 Btu/h/sq. ft.

## C. Instantaneous Water Heater

Gas	All	All	ANSI Z21.10.3	ET = 80 percent
Oil	All	All	ANSI Z21.10.3	EC = 83 percent

## D. Pool Heater

Gas or Oil	All	All	ANSI Z21.56	ET = 78 percent
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## TERMS:

EF = Energy factor, overall efficiency.

ET = Thermal efficiency with 70 degrees F delta T.

EC = Combustion efficiency, 100 percent - flue loss when smoke = 0 (trace is permitted).

SL = Standby loss in W/sq. ft. based on 80 degrees F delta T, or in percent per hour based on nominal 90 degrees F delta T.

HL = Heat loss of tank surface area

V = Storage volume in gallons

--End of Section--

## SECTION 15488

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN GAS ASSOCIATION (AGA)

AGA-01 (1989) A.G.A. Plastic Pipe Manual for Gas Service

AMERICAN NATIONAL STANDARDS INSTITUTE  
ANSI Z21.45 (1992; Z21.4a; Z21.4b) Flexible Connectors of Other  
Than All-Metal Construction for Gas Appliances

ANSI Z21.69 (1992; Z21.69a) Connectors for Movable Gas Appliances

## AMERICAN PETROLEUM INSTITUTE (API)

API Spec 6D (1994) Specification for Pipeline Valves (Gate, Plug, Ball, and Check Valves)

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.20.1 (1983; R 1992) Pipe Threads, General Purpose (Inch)

ASME B16.3 (1992) Malleable Iron Threaded Fittings

ASME B16.5 (1988; Errata Oct 88; B16.5a) Pipe Flanges and Flanged Fittings

ASME B16.9 (1993) Factory-Made Wrought Steel Buttwelding Fittings

ASME B16.11 (1991) Forged Fittings, Socket-Welding and Threaded

ASME B31.1 (1992; B31.1a; B31.1b) Power Piping

ASME B31.2 (1968) Fuel Gas Piping

ASME B36.10M (1985) Welded and Seamless Wrought Steel Pipe

ASME BPV IX (1992; Addenda Dec 1992, Dec 1993, Dec 1994) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS  
INDUSTRY (MSS)

MSS SP-25 (1993) Standard Marking System for Valves, Fittings, Flanges and Unions

MSS SP-58 (1993) Pipe Hangers and Supports - Materials, Design and Manufacture

MSS SP-69 (1991) Pipe Hangers and Supports - Selection and Application

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54 (1992) National Fuel Gas Code

NFPA 70 (1993) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL-06 (1994) Gas and Oil Equipment Directory

## **1.2 GENERAL REQUIREMENTS**

### **1.2.1 Welding**

Piping shall be welded in accordance with qualified procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified at least 24 hours in advance of tests and the tests shall be performed at the work site if practicable. The Contracting Officer shall be furnished with a copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record.

### **1.2.2 Jointing Thermoplastic and Fiberglass Piping**

Piping shall be jointed by performance qualified joiners using qualified procedures in accordance with AGA-01. Plastic Pipe Manual for Gas Service. The Contracting Officer shall be furnished with a copy of qualified procedures and list of and identification symbols of qualified joiners.

### **1.2.3 Standard Products**

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Asbestos or products containing asbestos shall not be used. Manufacturer's descriptive data and installation instructions shall be submitted for approval for compression-type mechanical joints used in joining dissimilar materials and for insulating joints. Valves, flanges and fittings shall be marked in accordance with MSS SP-25.

### **1.2.4 Verification of Dimensions**

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

## **PART 2 PRODUCTS**

### **2.1 PIPE AND FITTINGS**

#### **2.1.1 Steel Pipe, Joints, and Fittings**

Steel pipe shall conform to ASME B36.10M. Malleable-iron threaded fittings shall conform to ASME B16.3. Steel pipe flanges and flanged fittings including bolts, nuts, and bolt pattern shall be in accordance with ASME B16.5. Wrought steel butt welding fittings shall conform to ASME B16.9.

Socket welding and threaded forged steel fittings shall conform to ASME B16.11.

#### **2.1.2 Sealants for Steel Pipe Threaded Joints**

Joint sealing compound shall be listed in UL-06, Class 20 or less. Tetrafluoroethylene tape shall conform to UL-06.

#### **2.1.3 Identification**

Pipe flow markings and metal tags shall be provided as required.

#### **2.1.4 Flange Gaskets**

Gaskets shall be nonasbestos compressed material in accordance with ASME B16.21, 1/16 inch thickness, full face or self-centering flat ring type. The gaskets shall contain aramid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR) suitable for a maximum 600 degree F service. NBR binder shall be used for hydrocarbon service.

#### **2.1.5 Pipe Threads**

Pipe threads shall conform to ASME B1.20.1.

#### **2.1.6 Escutcheons**

Escutcheons shall be chromium-plated steel or chromium-plated brass, either one piece or split pattern, held in place by internal spring tension or set screw.

#### **2.1.7 Gas Transition Fittings**

Gas transition fittings shall be manufactured steel fittings approved for jointing metallic and thermoplastic or fiberglass pipe. Approved transition fittings are those that conform to AGA-01 requirements for transitions fittings.

#### **2.1.8 Insulating Pipe Joints**

##### **2.1.8.1 Insulating Joint Material**

Insulating joint material shall be provided between flanged or threaded metallic pipe systems where shown to control galvanic or electrical action.

##### **2.1.8.2 Threaded Pipe Joints**

Joints for threaded pipe shall be steel body nut type dielectric unions with insulating gaskets.

##### **2.1.8.3 Flanged Pipe Joints**

Joints for flanged pipe shall consist of full face sandwich-type flange insulating gasket of the dielectric type, insulating sleeves for flange bolts, and insulating washers for flange nuts.

#### **2.1.9 Flexible Connectors**

Flexible connectors for connecting gas utilization equipment to building gas piping shall conform to ANSI Z21.45. Flexible connectors for movable food service equipment shall conform to ANSI Z21.69.

## **2.2 VALVES**

Valves shall be suitable for shutoff or isolation service and shall conform to the following:

### **2.2.1 Valves 2 Inches and Smaller**

Valves 2 inches and smaller shall conform to ASME B16.33 and shall be of materials and manufacture compatible with system materials used.

### **2.2.2 Valves 2-1/2 Inches and Larger**

Valves 2-1/2 inches and larger shall be carbon steel conforming to API Spec 6D, Class 150.

## **2.3 PIPE HANGERS AND SUPPORTS**

Pipe hangers and supports shall conform to MSS SP-58 and MSS SP-69.

## **2.4 METERS, REGULATORS AND SHUTOFF VALVES**

Meters, regulators and shutoff valves shall be as specified in Section 02685 GAS DISTRIBUTION SYSTEM.

## **PART 3 EXECUTION**

### **3.1 EXCAVATION AND BACKFILLING**

Earthwork shall be as specified in Section 02222 EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITIES SYSTEMS.

### **3.2 GAS PIPING SYSTEM**

Gas piping system shall be considered as all above ground piping to the connections to each gas utilization device.

#### **3.2.1 Protection of Materials and Components**

Pipe and tube openings shall be closed with caps or plugs during installation. Equipment shall be protected from dirt, water, and chemical or mechanical damage. At the completion of all work, the entire system shall be thoroughly cleaned.

#### **3.2.2 Workmanship and Defects**

Piping, tubing and fittings shall be clear and free of cutting burrs and defects in structure or threading and shall be thoroughly brushed and chip-and scale-blown. Defects in piping, tubing or fittings shall not be repaired. When defective piping, tubing, or fittings are located in a system, the defective material shall be replaced.

### **3.3 PROTECTIVE COVERING**

#### **3.3.1 Ferrous Surfaces**

Shop primed surfaces shall be touched up with ferrous metal primer. Surfaces that have not been shop primed shall be solvent cleaned. Surfaces that contain loose rust, loose mill scale and other foreign substances shall be mechanically cleaned by power wire brushing and primed with ferrous metal primer. Primed surface shall be finished with two coats of exterior oil paint.

### **3.4 INSTALLATION**

Installation of the gas system shall be in conformance with the manufacturer's recommendations and applicable provisions of NFPA 54, AGA-01, and as indicated. Pipe cutting shall be done without damage to the pipe. Unless otherwise authorized, cutting shall be done by an approved type of mechanical cutter. Wheel cutters shall be used where practicable. On steel pipe 6 inches and larger, an approved gas cutting and beveling machine may be used. Cutting of thermoplastic and fiberglass pipe shall be in accordance with AGA-01.

#### **3.4.1 Metallic Piping Installation**

Underground piping shall be buried a minimum of 18 inches below grade. Changes in direction of piping shall be made with fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Aluminum alloy pipe shall not be used in exterior locations or underground.

#### **3.4.2 Connections Between Metallic and Plastic Piping**

Connections shall be made only outside, underground, and with approved transition fittings.

#### **3.4.3 Concealed Piping in Buildings**

When installing piping which is to be concealed, unions, tubing fittings, running threads, right- and left-hand couplings, bushings, and swing joints made by combinations of fittings shall not be used.

##### **3.4.3.1 Piping in Partitions**

Concealed piping shall be located in hollow rather than solid partitions. Tubing passing through walls or partitions shall be protected against physical damage.

##### **3.4.3.2 Piping in Floors**

Piping will not be allowed below concrete slab on grade.

#### **3.4.4 Aboveground Piping**

Aboveground piping shall be run as straight as practicable along the alignment indicated and with a minimum of joints. Piping shall be separately supported. Exposed horizontal piping shall not be installed farther than 6 inches from nearest parallel wall in laundry areas where clothes hanging could be attempted.

#### **3.4.5 Final Gas Connections**

Unless otherwise specified herein, final connections shall be made with rigid metallic pipe and fittings.

### **3.5 PIPE JOINTS**

Pipe joints shall be designed and installed to effectively sustain the longitudinal pull-out forces caused by contraction of the piping or superimposed loads.

### **3.5.1 Threaded Metallic Joints**

Threaded joints in metallic pipe shall have tapered threads evenly cut and shall be made with UL approved graphite joint sealing compound for gas service or tetrafluoroethylene tape applied to the male threads only. Threaded joints up to 1-1/2 inches in diameter may be made with approved tetrafluoroethylene tape. Threaded joints up to 2 inches in diameter may be made with approved joint sealing compound. After cutting and before threading, pipe shall be reamed and burrs shall be removed. Caulking of threaded joints to stop or prevent leaks shall not be permitted.

### **3.5.2 Welded Metallic Joints**

Beveling, alignment, heat treatment, and inspection of welds shall conform to ASME B31.2. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected adversely. Electrodes that have been wetted or have lost any of their coating shall not be used.

### **3.6 PIPE SLEEVES**

Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves shall not be installed in structural members except where indicated or approved. Each sleeve shall extend through its respective wall, floor or roof, and shall be cut flush with each surface, except in mechanical room floors not located on grade where clamping flanges or riser pipe clamps are used. Sleeves in mechanical room floors above grade shall extend at least 4 inches above finish floor. Unless otherwise indicated, sleeves shall be large enough to provide a minimum clearance of 1/4 inch all around the pipe. Sleeves in bearing walls, waterproofing membrane floors, and wet areas shall be steel pipe. Sleeves in nonbearing walls, floors, or ceilings may be steel pipe, galvanized sheet metal with lock-type longitudinal seam, or moisture-resistant fiber or plastic. For penetrations of fire walls, fire partitions and floors which are not on grade, the annular space between the pipe and sleeve shall be sealed with firestopping material and sealant that meet the requirement of Section 07270 FIRESTOPPING.

### **3.7 FIRE SEAL**

Penetrations of fire rated partitions, walls and floors shall be in accordance with Section 07270 FIRESTOPPING.

### **3.8 ESCUTCHEONS**

Escutcheons shall be provided for all finished surfaces where gas piping passes through floors, walls, or ceilings except in boiler, utility, or equipment rooms.

### **3.9 SPECIAL REQUIREMENTS**

Drips, grading of the lines, freeze protection, and branch outlet locations shall be as shown and shall conform to the requirements of NFPA 54.

### **3.10 BUILDING STRUCTURE**

Building structure shall not be weakened by the installation of any gas piping. Beams or joists shall not be cut or notched.



### **3.11 PIPING SYSTEM SUPPORTS**

Gas piping systems in buildings shall be supported with pipe hooks, metal pipe straps, bands or hangers suitable for the size of piping or tubing. Gas piping system shall not be supported by other piping. Spacing of supports in gas piping and tubing installations shall conform to the requirements of NFPA 54. The selection and application of supports in gas piping and tubing installations shall conform to the requirements of MSS SP-69. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for any of the individual pipes in the multiple pipe run. The clips or clamps shall be rigidly connected to the common base member. A clearance of 1/8 inch shall be provided between the pipe and clip or clamp for all piping which may be subjected to thermal expansion.

### **3.12 ELECTRICAL BONDING AND GROUNDING**

A gas piping system within a building shall be electrically continuous and bonded to a grounding electrode as required by NFPA 70.

### **3.13 SHUTOFF VALVE**

Main gas shutoff valve controlling the gas piping system shall be easily accessible for operation and shall be installed as indicated, protected from physical damage, and marked with a metal tag to clearly identify the piping system controlled.

### **3.14 TESTING**

Before any section of a gas piping system is put into service, it shall be carefully tested to assure that it is gastight. Prior to testing, the system shall be blown out, cleaned and cleared of all foreign material. Each joint shall be tested by means of an approved gas detector, soap and water, or an equivalent nonflammable solution. Testing shall be completed before any work is covered, enclosed, or concealed. All testing of piping systems shall be done with due regard for the safety of employees and the public during the test. Bulkheads, anchorage and bracing suitably designed to resist test pressures shall be installed if necessary. Oxygen shall not be used as a testing medium.

#### **3.14.1 Pressure Tests**

Before appliances are connected, piping systems shall be filled with air or an inert gas and shall withstand a minimum pressure of 3 pounds gauge for a period of not less than 10 minutes as specified in NFPA 54 without showing any drop in pressure. Oxygen shall not be used. Pressure shall be measured with a mercury manometer, slope gauge, or an equivalent device so calibrated as to be read in increments of not greater than 0.1 pound. The source of pressure shall be isolated before the pressure tests are made.

#### **3.14.2 Test With Gas**

Before turning gas under pressure into any piping, all openings from which gas can escape shall be closed. Immediately after turning on the gas, the piping system shall be checked for leakage by using a laboratory-certified gas meter, an appliance orifice, a manometer, or equivalent device. All testing shall conform to the requirements of NFPA 54. If leakage is recorded, the gas supply shall be shut off, the leak shall be repaired, and the tests repeated until all leaks have been stopped.

### **3.14.3 Purging**

After testing is completed, and before connecting any appliances, all gas piping shall be fully purged. LPG piping tested using fuel gas with appliances connected does not require purging. Piping shall not be purged into the combustion chamber of an appliance. The open end of piping systems being purged shall not discharge into confined spaces or areas where there are ignition sources unless the safety precautions recommended in NFPA 54 are followed.

### **3.14.4 Labor, Materials and Equipment**

All labor, materials and equipment necessary for conducting the testing and purging shall be furnished by the Contractor.

--End of Section--

## SECTION 15569

### WATER HEATING; GAS; UP TO 20 MBTUH

#### PART 1 GENERAL

##### 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

##### AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.13 (1991; Z21.13a; Z21.13b) Gas-Fired Low-Pressure Steam and Hot Water Boilers

##### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53 (1993a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

ASTM A 105 (1994) Forgings, Carbon Steel, for Piping Components

ASTM A 193 (1994b) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service

ASTM A 234 (1994) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

ASTM A 366 (1991; R 1993) Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality

ASTM A 515 (1992) Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service

ASTM A 516 (1990) Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service

ASTM A 526 (1990) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality

ASTM B 32 (1993) Solder Metal

ASTM B 62 (1993) Composition Bronze or Ounce Metal Castings

ASTM B 75 (1993) Seamless Copper Tube

ASTM B 88 (1993a) Seamless Copper Water Tube

ASTM B 813 (1993) Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube

##### AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.20.1 (1983; R 1992) Pipe Threads, General Purpose (Inch)

ASME B16.4 (1992) Cast Iron Threaded Fittings Class 125 and 250

ASME B16.5	(1988; Errata Oct 88; B16.5a) Pipe Flanges and Flanged Fittings
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1991) Forged Steel Fittings, Socket-Welding and Threaded
ASME B16.18	(1984) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(1989) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.39	(1986) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300
ASME B31.1	(1992; B31.1a; B31.1b; B31.1c) Power Piping
ASME B31.5	(1992; B31.5a) Refrigeration Piping
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPV IV	(1929; Addenda Dec 1992, Dec 1993, Dec 1994) Boiler and Pressure Vessel Code; Section IV, Heating Boilers
ASME BPV VIII Div 1	(1992; Addenda Dec 1992, Dec 1993, Dec 1994) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage
ASME BPV IX	(1992; Addenda Dec 1992, Dec 1993, Dec 1994) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications
ASME CSD-1	(1992; CSD-1a; CSD1b) Controls and Safety Devices for Automatically Fired Boilers

#### AMERICAN WELDING SOCIETY (AWS)

AWS A5.8	(1992) Filler Metals for Brazing and Braze Welding
AWS B2.2	(1991) Brazing Procedure and Performance Qualification

#### COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA 404/0-RR	(1992) Copper Tube for Plumbing, Heating, Air Conditioning and Refrigeration
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#### FEDERAL SPECIFICATIONS (FS)

FS QQ-B-654	(Rev A; Am 1; Notice 1) Brazing Alloys, Silver
FS WW-P-521	(Rev G) Pipe Fittings, Flange Fittings, and Flanges: Steel and Malleable Iron (Threaded and Butt-Welding) Class 150

FS WW-U-516	(Rev B; Notice 1) Unions, Brass or Bronze, Threaded Pipe Connections and Solder-Joint Tube Connections
HYDRONICS INSTITUTE (HYI)	
HYI-01	(1994) I=B=R Ratings for Boilers, Baseboard Radiation and Finned Tube (Commercial) Radiation
MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)	
MSS SP-25	(1993) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(1991) Pipe Hangers and Supports - Selection and Application
MSS SP-70	(1990) Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-73	(1991) Brazing Joints for Copper and Copper Alloy Pressure Fittings
MSS SP-80	(1987) Bronze Gate, Globe, Angle and Check Valves
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 54	(1992) National Fuel Gas Code
NFPA 70	(1993) National Electrical Code
NFPA 85C	(1991) Prevention of Furnace Explosions/Implosions in Multiple Burner Boiler-Furnaces
NFPA 211	(1992) Chimneys, Fireplaces, Vents and Solid Fuel-Burning Appliances
UNDERWRITERS LABORATORIES (UL)	
UL-06	(1994) Gas and Oil Equipment Directory

## **1.2 GENERAL REQUIREMENTS**

### **1.2.1 Standard Products**

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

### **1.2.2 Asbestos Prohibition**

Asbestos and asbestos-containing products shall not be used.

### **1.2.3 Nameplates**

Each major component of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the equipment. Each pressure vessel shall have an approved ASME stamp.

### **1.2.4 Equipment Guards**

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact shall be fully enclosed or guarded in accordance with OSHA requirements. High temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard shall be properly guarded or covered with insulation of a type specified.

### **1.2.5 Verification of Dimensions**

The Contractor shall become familiar with details of the work, verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work or ordering any materials.

### **1.2.6 Welding**

Boilers and piping shall be welded and brazed in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests, and the tests shall be performed at the work site if practical. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record.

## **1.3 MANUFACTURER'S SERVICES**

Services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified shall be provided. The representative shall supervise the installing, adjusting, and testing of the equipment.

## **1.4 DELIVERY AND STORAGE**

Equipment delivered and placed in storage shall be protected from the weather, humidity and temperature variations, dirt and dust, and other contaminants.

## **PART 2 PRODUCTS**

### **2.1 BOILERS**

Each boiler shall have the output capacity in British thermal units per hour (Btuh) as required to meet building heating demand when fired with natural gas. The boiler shall be furnished complete with the burning equipment, boiler fittings and trim, automatic controls, electrical wiring, insulation, piping connections, and protective jacket. The boiler shall be completely assembled and tested at the manufacturer's plant. The boiler and its accessories shall be designed and installed to permit ready accessibility for operation, maintenance, and service. Boilers shall be designed, constructed, and equipped in accordance with ASME BPV IV. Each boiler shall be of the

finned watertube type and designed for water service as specified herein. The boiler capacity shall be based on the ratings shown in HYI-01 or as certified by the American Boiler Manufacturers Association, or American Gas Association.

### **2.1.1 Watertube Boiler**

Boiler shall be self-contained, packaged type, complete with all accessories, mounted on a structural steel base. The heat input rate for finned tube designs shall not be greater than 12,000 Btu/hr per square ft based on internal heater area.

## **2.2 FUEL BURNING EQUIPMENT**

Boiler shall be designed to burn gas. Each boiler shall comply with Federal, state, and local emission regulations.

### **2.2.1 Low-water Cutoff**

Low-water cutoff shall be provided to stop the burner and draft fan when the water level drops below a predetermined point. The cutoff shall consist of a float chamber with float, float switch, and drain valve. The float switch shall be mounted on the float chamber with a packless-type leakproof connection. The float mechanism and drain valve shall be constructed of a corrosion-resistant material. The low-water cutoff shall be UL-06 listed and shall be furnished with approved fittings and installed according to ASME boiler code requirements. The following type of low-water cutoff shall be utilized.

- a. Low-Water Cutoff: Low-water cutoff of the float activated type shall be provided. Low-water cutoff shall be mounted directly in the boiler shell or piping and shall be set below the low-water cutoff required above.

### **2.2.2 Water Flow Interlock**

Hot water boiler limit controls shall be provided to include protection for low boiler water flow and high boiler water temperature. The limit controls shall be interlocked with the combustion control system to effect boiler alarm and shutdown. The controls shall not allow boiler startup unless hot water flow is proven.

## **2.3 PUMPS**

### **2.3.1 Dual Temperature and Boiler Circulating Pumps**

Circulating pumps shall be electrically driven single-stage centrifugal type and have a capacity as required for the Contractor designed system. Circulating pumps shall be supported on a concrete foundation with a cast iron or structural steel base and shall be flexible-coupled shaft. The circulating pumps shall be bronze fitted end-suction vertical split case type with suction diffusers. The pump shaft shall be constructed of corrosion-resistant alloy steel, sleeve bearings and glands of bronze designed to accommodate a mechanical seal, and the housing of close-grained cast iron. Pump seals shall be capable of withstanding 240 degrees F temperature without external cooling. The motor shall have sufficient power for the service required, shall be of a type approved by the manufacturer of the pump, shall be suitable for the available electric service, and shall conform to the requirements of paragraph ELECTRICAL EQUIPMENT. Each pump suction and discharge connection shall be provided with a pressure gauge as specified.

## **2.4 FITTINGS AND ACCESSORIES**

Boiler fittings and accessories shall be installed with each boiler in accordance with ASME BPV IV, unless otherwise specified.

### **2.4.1 Conventional Breeching and Stacks**

#### **2.4.1.1 Breeching**

If required for boiler supplied, boiler shall be connected to the stack or flue by breeching constructed of black steel sheets not less than 0.0478 inch thick nor less than thickness of stack, whichever is larger. The clear distance between any portion of the breeching surface and any combustible material shall not be less than that specified in NFPA 211. Joints and seams shall be securely fastened and made airtight. Suitable hinged and gasketed cleanouts shall be provided, which will permit cleaning the entire smoke connection without dismantling. Flexible-type expansion joints shall be provided as required and shall not require packing.

#### **2.4.1.2 Stacks**

Prefabricated double wall stacks system shall extend above the roof to the height required to meet building codes. The inner stack shall be 316 stainless steel having a thickness of not less than 0.035 inch. The outer stack shall be sheet steel having a thickness of not less than 0.025 inch. A method of maintaining concentricity between the inner and outer stacks shall be incorporated. The joints between the stack sections shall be sealed to prevent flue gas leakage. A 0.3125 inch diameter hole shall be provided in the stack not greater than 6 inches from the furnace flue outlet for sampling of the exit gases. A method shall be provided to seal the hole to prevent exhaust gases from entering the boiler room when samples are not being taken. Each stack shall be provided complete with rain hood.

### **2.4.2 Expansion Tank**

The hot water pressurization system shall include a diaphragm-type expansion tank which will accommodate the expanded water of the system generated within the normal operating temperature range, limiting the pressure increase at all components in the system to the maximum allowable pressure at those components. The only air in the system shall be the permanent sealed-in air cushion contained in the diaphragm-type tank. The sizes shall be as required for the Contractor designed system. The expansion tank shall be welded steel, constructed, tested, and stamped in accordance with ASME BPV VIII Div 1 for a working pressure of 125 psi and precharged to the minimum operating pressure. The tank's air chamber shall be fitted with an air charging valve and pressure gauge. The tank shall be supported by steel legs or bases for vertical installation or steel saddles for horizontal installations. The tank shall have lifting rings and a drain connection. All components shall be suitable for a maximum operating temperature of 250 degrees F.

### **2.4.3 Air Separator**

External air separation tank shall be steel, constructed, tested and stamped in accordance with ASME BPV VIII Div 1 for a working pressure of 125 psi. The capacity of the air separation tank shall be line-size and installed on the suction-side of the boiler pump.

### **2.4.4 Filters**

Filters shall conform to ASTM F 872.



#### **2.4.5 Steel Sheets**

##### **2.4.5.1 Galvanized Steel**

Galvanized steel shall be ASTM A 526.

##### **2.4.5.2 Uncoated Steel**

Uncoated steel shall be ASTM A 366, composition, condition, and finish best suited to the intended use. Gauge numbers specified refer to manufacturer's standard gauge.

#### **2.4.6 Gaskets**

Gaskets shall be nonasbestos material in accordance with ASME B16.21, full face or self-centering type. The gaskets shall be of the spiral wound type with graphite filler material.

#### **2.4.7 Steel Pipe and Fittings**

##### **2.4.7.1 Steel Pipe**

Steel pipe shall be ASTM A 53, Type E or S, Grade A or B, black steel, standard weight.

##### **2.4.7.2 Steel Pipe Fittings**

Fittings shall have the manufacturer's trademark affixed in accordance with MSS SP-25 so as to permanently identify the manufacturer.

##### **2.4.7.3 Steel Flanges**

Flanged fittings including flanges, bolts, nuts, bolt patterns, etc. shall be in accordance with ASME B16.5 class 150 and shall have the manufacturers trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A 105. Flanges for high temperature water systems shall be serrated or raised-face type. Blind flange material shall conform to ASTM A 516 cold service and ASTM A 515 for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A 193.

##### **2.4.7.4 Welded Fittings**

Welded fittings shall conform to ASTM A 234 with WPA marking. Buttwelded fittings shall conform to ASME B16.9, and socket-welded fittings shall conform to ASME B16.11.

##### **2.4.7.5 Cast-Iron Fittings**

Fittings shall be ASME B16.4, Class 125, type required to match connecting piping.

##### **2.4.7.6 Malleable-Iron Fittings**

Fittings shall be FS WW-P-521, type as required to match connecting piping.

##### **2.4.7.7 Unions**

Unions shall be ASME B16.39, Class 150.

##### **2.4.7.8 Threads**

Pipe threads shall conform to ASME B1.20.1.

## **2.4.8 Copper Tubing and Fittings**

### **2.4.8.1 Copper Tubing**

Tubing shall be ASTM B 88, Type K or L. Adapters for copper tubing shall be brass or bronze for brazed fittings.

### **2.4.8.2 Solder-Joint Pressure Fittings**

Wrought copper and bronze solder-joint pressure fittings shall conform to ASME B16.22 and ASTM B 75. Cast copper alloy solder-joint pressure fittings shall conform to ASME B16.18.

### **2.4.8.3 Flared Fittings**

Cast copper alloy fittings for flared copper tube shall conform to ASME B16.26 and ASTM B 62.

### **2.4.8.4 Adapters**

Adapters may be used for connecting tubing to flanges and to threaded ends of valves and equipment. Extracted brazed tee joints produced with an acceptable tool and installed as recommended by the manufacturer may be used.

### **2.4.8.5 Unions**

Unions shall conform to FS WW-U-516 for brass or bronze.

### **2.4.8.6 Brazing Material**

Brazing material shall conform to AWS A5.8.

### **2.4.8.7 Brazing Flux**

Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have a 100 percent flushable residue; contain slightly acidic reagents; contain potassium borides, and contain fluorides. Silver brazing materials shall be in accordance with FS QQ-B-654.

### **2.4.8.8 Solder Material**

Solder metal shall conform to ASTM B 32 95-5 tin-antimony.

### **2.4.8.9 Solder Flux**

Flux shall be liquid form, non-corrosive, and conform to ASTM B 813, Standard Test 1.

## **2.4.9 Dielectric Unions**

Dielectric unions shall have metal connections on both ends. The ends shall be threaded, flanged, or brazed to match adjacent piping. Metal parts of the union shall be separated so that the electrical current is below 1 percent of the galvanic current which would exist upon metal-to-metal contact.

## **2.4.10 Flexible Pipe Connectors**

Flexible pipe connectors shall be designed for 125 psi or 150 psi service. Connectors shall be installed at each pump suction and discharge connection. The flexible section shall be constructed of rubber, tetrafluoroethylene

resin, or corrosion-resisting steel, bronze, monel, or galvanized steel. Materials used and the configuration shall be suitable for the pressure, vacuum, and temperature medium. The flexible section shall be suitable for service intended and may have threaded, welded, soldered, flanged, or socket ends. Flanged assemblies shall be equipped with limit bolts to restrict maximum travel to the manufacturer's standard limits. Unless otherwise indicated, the length of the flexible connectors shall be as recommended by the manufacturer for the service intended. Internal sleeves or liners, compatible with circulating medium, shall be provided when recommended by the manufacturer. Covers to protect the bellows shall be provided where indicated.

#### **2.4.11 Pipe Supports**

Pipe supports shall conform to MSS SP-58 and MSS SP-69.

#### **2.4.12 Pipe Expansion**

##### **2.4.12.1 Expansion Loops**

Expansion loops and offsets shall provide adequate expansion of the main straight runs of the system within the stress limits specified in ASME B31.1. The loops and offsets shall be cold-sprung and installed where indicated. Pipe guides and anchors shall be provided as indicated.

#### **2.4.13 Valves**

Valves shall be Class 125 and shall be suitable for the application. Valves in nonboiler external piping shall meet the material, fabrication and operating requirements of ASME B31.1. The connection type of all valves shall match the same type of connection required for the piping on which installed.

##### **2.4.13.1 Gate Valves**

Gate valves 2-1/2 inches and smaller shall conform to MSS SP-80 bronze rising stem, threaded, solder, or flanged ends. Gate valves 3 inches and larger shall conform to MSS SP-70 cast iron bronze trim, outside screw and yoke, flanged, or threaded ends.

##### **2.4.13.2 Globe Valves**

Globe valves 2-1/2 inches and smaller shall conform to MSS SP-80, bronze, threaded, soldered, or flanged ends. Globe valves 3 inches and larger shall conform to MSS SP-85, cast iron, bronze trim, flanged, or threaded ends.

##### **2.4.13.3 Check Valves**

Check valves 2-1/2 inches and smaller shall conform to MSS SP-80, bronze, threaded, soldered, or flanged ends. Check valves 3 inches and larger shall conform to MSS SP-71, cast iron, bronze trim, flanged, or threaded ends.

##### **2.4.13.4 Angle Valves**

Angle valves 2-1/2 inches and smaller shall conform to MSS SP-80 bronze, threaded, soldered, or flanged ends. Angle valves 3 inches and larger shall conform to MSS SP-85, cast iron, bronze trim, flanged, or threaded ends.

##### **2.4.13.5 Ball Valves**

Ball valves 1/2 inch and larger shall conform to FS WW-V-35, ductile iron or bronze, threaded, soldered, or flanged ends.

#### **2.4.13.6 Plug Valves**

Plug valves 2 in. and larger shall conform to MSS SP-78. Plug valves smaller than 2 in. shall conform to ASME B16.34.

#### **2.4.13.7 Balancing Valves**

Balancing valves shall have meter connections with positive shutoff valves. An integral pointer shall register the degree of valve opening. Valves shall be calibrated so that flow rate can be determined when valve opening in degrees and pressure differential across valve is known. Each balancing valve shall be constructed with internal seals to prevent leakage and shall be supplied with preformed insulation. Valves shall be suitable for 250 degrees F temperature and working pressure of the pipe in which installed. Valve bodies shall be provided with tapped openings and pipe extensions with shutoff valves outside of pipe insulation. The pipe extensions shall be provided with quick connecting hose fittings for a portable meter to measure the pressure differential. One portable differential meter shall be furnished. The meter suitable for the operating pressure specified shall be complete with hoses, vent, and shutoff valves, and carrying case. In lieu of the balancing valve with integral metering connections, a ball valve or plug valve with a separately installed orifice plate or venturi tube may be used for balancing.

#### **2.4.13.8 Butterfly Valves**

Butterfly valves shall be 2-flange type or lug wafer type, and shall be bubbletight at 150 psig. Valve bodies shall be cast iron, malleable iron, or steel. ASTM A 167, Type 404 or Type 316, corrosion resisting steel stems, bronze, or corrosion resisting steel discs, and synthetic rubber seats shall be provided. Valves smaller than 8 inches shall have throttling handles with a minimum of seven locking positions. Valves 8 inches and larger shall have totally enclosed manual gear operators with adjustable balance return stops and position indicators. Valves in insulated lines shall have extended neck to accommodate insulation thickness.

#### **2.4.13.9 Drain valves**

Drain valves shall be provided at each drain point of blowdown as recommended by the boiler manufacturer. Piping shall conform to ASME BPV IV and ASTM A 53.

#### **2.4.13.10 Safety Valves**

Safety valves shall have steel bodies and shall be equipped with corrosion-resistant trim and valve seats. The valves shall be properly guided and shall be positive closing so that no leakage can occur. Adjustment of the desired back-pressure shall cover the range between 2 and 10 psig. The adjustment shall be made externally, and any shafts extending through the valve body shall be provided with adjustable stuffing boxes having renewable packing. Boiler safety valves of proper size and of the required number, in accordance with ASME BPV IV, shall be installed so that the discharge will be through piping extended to the outdoors. Each discharge pipe for hot water service shall be pitched away from the valve seat.

#### **2.4.14 Strainers**

Basket and "Y" type strainers shall be the same size as the pipelines in which they are installed. The strainer bodies shall be heavy and durable, fabricated of cast iron, and shall have bottoms drilled and tapped with a gate valve attached for blowdown purposes. Strainers shall be designed for 125 psig service and 250 degrees F. The bodies shall have arrows clearly cast on the sides indicating the direction of flow. Each strainer shall be equipped

with an easily removable cover and sediment screen. The screen shall be made of 22 gauge brass sheet with small perforations numbering not less than 400 per square inch to provide a net free area through the basket of at least 3.30 times that of the entering pipe. The flow shall be into the screen and out through the perforations.

#### **2.4.15 Pressure Gauges**

Gauges shall conform to ASME B40.1 and shall be provided with throttling type needle valve or a pulsation dampener and shutoff valve. Minimum dial size shall be 3-1/2 inches. A pressure gauge shall be provided for each boiler in a visible location on the boiler.

#### **2.4.16 Thermometers**

Thermometers shall be provided with wells and separable corrosion-resistant steel sockets. Thermometers for inlet water and outlet water for each hot water boiler shall be provided in a visible location on the boiler. Thermometers shall have brass, malleable iron, or aluminum alloy case and frame, clear protective face, permanently stabilized glass tube with indicating-fluid column, white face, black numbers, and a minimum 9 inch scale.

#### **2.4.17 Air Vents**

##### **2.4.17.1 Manual Air Vents**

Manual air vents shall be brass or bronze valves or cocks suitable for the pressure rating of the piping system and furnished with threaded plugs or caps.

##### **2.4.17.2 Automatic Air Vents**

Automatic air vents shall be 3/4 inch quick-venting float and vacuum air valves. Each air vent valve shall have a large port permitting the expulsion of the air without developing excessive back pressure, a noncollapsible metal float which will close the valve and prevent the loss of water from the system, an air seal that will effectively close and prevent the re-entry of air into the system when subatmospheric pressures prevail therein, and a thermostatic member that will close the port against the passage of steam from the system. The name of the manufacturer shall be clearly stamped on the outside of each valve. The air vent valve shall be suitable for the pressure rating of the piping system.

### **2.5 ELECTRICAL EQUIPMENT**

Electric motor-driven equipment shall be provided complete with motors, motor starters, and necessary control devices. Electrical equipment, motor control devices, motor efficiencies and wiring shall be as specified in Section 16415 ELECTRICAL WORK, INTERIOR. Motors which are an integral part of the packaged boiler shall be the highest efficiency available by the manufacturer of the packaged boiler. Motor starters shall be provided complete with properly sized thermal overload protections and other appurtenances necessary for the motor control specified. Starters shall be furnished in general purpose enclosures. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices but not shown shall be provided.

#### **2.5.1 Motor Ratings**

Motors shall be suitable for the voltage and frequency provided. Motors 1/2 hp and larger shall be three-phase, unless otherwise indicated. Motors shall

be of sufficient capacity to drive the equipment at the specified capacity without exceeding the nameplate rating on the motor.

### **2.5.2 Motor Controls**

Motor controllers shall be provided complete with properly sized thermal overload protection. Manual or automatic control and protective or signal devices required for the operation specified and any wiring required to such devices shall be provided.

### **2.6 INSULATION**

Shop and field-applied insulation shall be as specified in Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

## **PART 3 EXECUTION**

### **3.1 ERECTION OF BOILER AND AUXILIARY EQUIPMENT**

Boiler and auxiliary equipment shall be installed in accordance with manufacturer's written instructions.

### **3.2 PIPING INSTALLATION**

Unless otherwise specified, nonboiler external pipe and fittings shall conform to the requirements of ASME B31.1. Pipe installed shall be cut accurately to suit field conditions, shall be installed without springing or forcing, and shall properly clear windows, doors, and other openings. Cutting or other weakening of the building structure to facilitate piping installation will not be permitted. Pipes shall be free of burrs, oil, grease and other foreign material and shall be installed to permit free expansion and contraction without damaging the building structure, pipe, pipe joints, or pipe supports. Changes in direction shall be made with fittings. Vent pipes shall be carried through the roof as directed and shall be properly flashed. Unless otherwise indicated, horizontal supply mains shall pitch down in the direction of flow with a maximum grade permitted by building constraints. Open ends of pipelines and equipment shall be properly capped or plugged during installation to keep dirt or other foreign materials out of the systems. Pipe not otherwise specified shall be uncoated. Unless otherwise specified or shown, final connections to equipment shall be made with malleable-iron unions for steel pipe 2-1/2 inches or less in diameter and with flanges for pipe 3 inches or more in diameter. Unions for copper pipe or tubing shall be brass or bronze. Reducing fittings shall be used for changes in pipe sizes. In horizontal hot water lines, reducing fittings shall be eccentric type to maintain the top of the lines at the same level to prevent air binding.

#### **3.2.1 Cold Water Connections**

Cold water fill connections shall be made to the water supply system to the suction side of the boiler pump. Necessary pipe, fittings, and valves required for water connections between the boiler and cold water main shall be provided. At a minimum, provide regulator (all bronze), relief valve, pressure gauge, bypass and backflow preventer. The pressure regulating valve shall be of a type that will not stick or allow pressure to build up on the low side. The valve shall be set to maintain a terminal pressure of approximately 5 psi in excess of the static head on the system and shall operate within a 2 psi tolerance regardless of cold water supply piping pressure and without objectionable noise under any condition of operation.

### **3.2.2 Chilled Water, Hot Water and Dual Temperature Piping and Fittings**

Pipe shall be black steel or copper tubing. Fittings for steel piping shall be black malleable iron or cast iron to suit piping. Fittings adjacent to valves shall suit valve material. Grooved mechanical fittings will not be allowed for water temperatures above 230 degrees F.

### **3.2.3 Gauge Piping**

Piping shall be copper tubing.

### **3.2.4 Joints**

Joints between sections of steel pipe and between steel pipe and fittings shall be threaded, grooved, flanged or welded as indicated or specified. Except as otherwise specified, fittings 1 inch and smaller shall be threaded; fittings 1-1/4 inches and up to but not including 3 inches shall be either threaded, grooved, or welded; and fittings 3 inches and larger shall be either flanged, grooved, or welded. Pipe and fittings 1-1/4 inches and larger installed in inaccessible conduit or trenches beneath concrete floor slabs shall be welded. Connections to equipment shall be made with black malleable-iron unions for pipe 2-1/2 inches or smaller in diameter and with flanges for pipe 3 inches or larger in diameter. Joints between sections of copper tubing or pipe shall be flared, soldered, or brazed.

#### **3.2.4.1 Threaded Joints**

Threaded joints shall be made with tapered threads properly cut and shall be made perfectly tight with a stiff mixture of graphite and oil or with polytetrafluoroethylene tape applied to the male threads only and in no case to the fittings.

#### **3.2.4.2 Welded Joints**

Welded joints shall be in accordance with paragraph GENERAL REQUIREMENTS unless otherwise specified. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connections may be made with either welding tees or forged branch outlet fittings, either being acceptable without size limitation. Branch outlet fittings, where used, shall be forged, flared for improved flow characteristics where attached to the run, reinforced against external strains, and designed to withstand full pipe bursting strength. Socket weld joints shall be assembled so that the space between the end of the pipe and the bottom of the socket is no less than 1/16 inch and no more than 1/8 inch.

#### **3.2.4.3 Flared and Brazed Copper Pipe and Tubing**

Tubing shall be cut square, and burrs shall be removed. Both inside of fittings and outside of tubing shall be cleaned thoroughly with sand cloth or steel wire brush before brazing. Annealing of fittings and hard-drawn tubing shall not occur when making connections. Installation shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Brazed joints shall be made in conformance with AWS B2.2, MSS SP-73, and CDA 404/0-RR with flux. Copper-to-copper joints shall include the use of copper-phosphorous or copper-phosphorous-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorous, copper-phosphorous-silver or a silver brazing filler metal. Joints for flared fittings shall be of the compression pattern. Swing joints or offsets shall be provided in all branch connections, mains, and risers to provide for expansion and contraction forces

without undue stress to the fittings or to short lengths of pipe or tubing. Flared or brazed copper tubing to pipe adapters shall be provided where necessary for joining threaded pipe to copper tubing.

#### **3.2.4.4 Soldered Joints**

Soldered joints shall be made with flux and are only acceptable for lines 2 inches and smaller. Soldered joints shall conform to ASME B31.5 and CDA 404/0-RR.

#### **3.2.4.5 Copper Tube Extracted Joint**

An extruded mechanical tee joint may be made in copper tube. Joint shall be produced with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, dimpled depth stops shall be provided. The branch tube shall be notched for proper penetration into fitting to assure a free flow joint. Extracted joints shall be brazed using a copper phosphorous classification brazing filler metal. Soldered joints will not be permitted.

#### **3.2.5 Flanges and Unions**

Flanges shall be faced true, provided with 1/16 inch thick gaskets, and made square and tight. Where steel flanges mate with cast-iron flanged fittings, valves, or equipment, they shall be provided with flat faces and full face gaskets. Union or flange joints shall be provided in each line immediately preceding the connection to each piece of equipment or material requiring maintenance such as coils, pumps, control valves, and other similar items. Dielectric pipe unions shall be provided between ferrous and nonferrous piping to prevent galvanic corrosion. The dielectric unions shall have metal connections on both ends. The ends shall be threaded, flanged, or brazed to match adjacent piping. The metal parts of the union shall be separated so that the electrical current is below 1 percent of the galvanic current which would exist upon metal-to-metal contact. Gaskets, flanges, and unions shall be installed in accordance with manufacturer's recommendations.

#### **3.2.6 Branch Connections**

##### **3.2.6.1 Branch Connections for Dual Temperature, Chilled and Hot Water Systems**

Branches from the main shall pitch up or down as shown to prevent air entrapment. Connections shall ensure unrestricted circulation, eliminate air pockets, and permit complete drainage of the system. Branches shall pitch with a grade of not less than 1 inch in 10 feet.

#### **3.2.7 Flared, Brazed, and Soldered Copper Pipe and Tubing**

Copper tubing shall be flared, brazed, or soldered. Tubing shall be cut square, and burrs shall be removed. Both inside of fittings and outside of tubing shall be cleaned thoroughly with sand cloth or steel wire brush before brazing. Annealing of fittings and hard-drawn tubing shall not occur when making connections. Installation shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints for flared fittings shall be of the compression pattern. Swing joints or offsets shall be provided on branch connections, mains, and risers to provide for expansion and contraction forces without undue stress to the fittings or to short lengths of pipe or tubing. Pipe adapters shall be provided where necessary for joining threaded pipe to copper tubing. Brazed joints shall be made in



conformance with MSS SP-73, and CDA 404/0-RR. Copper-to-copper joints shall include the use of copper-phosphorous or copper-phosphorous-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorous, copper-phosphorous-silver, or a silver brazing filler metal. Soldered joints shall be made with flux and are only acceptable for lines 2 inches or smaller. Soldered joints shall conform to ASME B31.5 and shall be in accordance with CDA 404/0-RR.

### **3.2.8 Copper Tube Extracted Joint**

An extracted mechanical tee joint may be made in copper tube. Joint shall be produced with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, dimpled depth stops shall be provided. The branch tube shall be notched for proper penetration into fitting to assure a free flow joint. Extracted joints shall be brazed using a copper phosphorous classification brazing filler metal. Soldered joints will not be permitted.

### **3.2.9 Supports**

#### **3.2.9.1 General**

Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers.

#### **3.2.9.2 Pipe Hangers, Inserts, and Supports**

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein.

- a. Types 5, 12, and 26 shall not be used.
- b. Type 3 shall not be used on insulated pipe which has a vapor barrier. Type 3 may be used on insulated pipe that does not have a vapor barrier if clamped directly to the pipe, if the clamp bottom does not extend through the insulation, and if the top clamp attachment does not contact the insulation during pipe movement.
- c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for Type 18 inserts.
- d. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and have both locknuts and retaining devices furnished by the manufacturer. Field fabricated C-clamp bodies or retaining devices are not acceptable.
- e. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.
- f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

g. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves.

h. Vertical pipe shall be supported at each floor, except at slab-on-grade, and at intervals of not more than 15 feet, not more than 8 feet from end of risers, and at vent terminations.

i. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided where required to allow longitudinal pipe movement. Lateral restraints shall be provided as required. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered.

(1) Where steel slides do not require provisions for restraint of lateral movement, an alternate guide method may be used. On piping 4 inches and larger, a Type 39 saddle may be welded to the pipe and freely rested on a steel plate. On piping under 4 inches, a Type 40 protection shield may be attached to the pipe or insulation and freely rested on a steel slide plate.

(2) Where there are high system temperatures and welding to piping is not desirable, the Type 35 guide shall include a pipe cradle welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 4 inches or by an amount adequate for the insulation, whichever is greater.

j. Except for Type 3, pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation.

k. Piping in trenches shall be supported as indicated.

l. Structural steel attachments and brackets required to support piping, headers, and equipment, but not shown, shall be provided under this section. Material and installation shall be as specified under Section 05120 STRUCTURAL STEEL. Pipe hanger loads suspended from steel joist between panel points shall not exceed 50 pounds. Loads exceeding 50 pounds shall be suspended from panel points.

### **3.2.9.3 Multiple Pipe Runs**

In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support member shall not exceed the hanger and support spacing required for any individual pipe in the multiple pipe run. The clips or clamps shall be rigidly attached to the common base member. A clearance of 1/8 inch shall be provided between the pipe insulation and the clip or clamp for piping which may be subjected to thermal expansion.

### **3.2.10 Anchors**

Anchors shall be provided where necessary to localize expansion or to prevent undue strain on piping. Anchors shall consist of heavy steel collars with lugs and bolts for clamping and attaching anchor braces, unless otherwise indicated. Anchor braces shall be installed in the most effective manner to secure the desired results, using turnbuckles where required. Supports, anchors, or stays shall not be attached where they will injure the structure or adjacent construction during installation or by the weight of expansion of the pipeline.

### **3.2.11 Valves**

Valves shall be installed where specified and required for functioning and servicing of the systems. Valves shall be safely accessible. Swing check valves shall be installed upright in horizontal lines and in vertical lines only when flow is in the upward direction. Gate and globe valves shall be installed with stems horizontal or above. Valves to be brazed shall be disassembled prior to brazing and all packing removed. After brazing, the valves shall be allowed to cool before reassembling.

### **3.2.12 Pipe Sleeves**

Pipe passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. A waterproofing clamping flange shall be installed as indicated where membranes are involved. Sleeves shall not be installed in structural members except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective wall, floor, or roof. Sleeves through walls shall be cut flush with wall surface. Sleeves through floors shall be cut flush with floor surface. Sleeves through roofs shall extend above the top surface of roof at least 6 inches for proper flashing or finishing. Unless otherwise indicated, sleeves shall be sized to provide a minimum clearance of 1/4 inch between bare pipe and sleeves or between jacket over insulation and sleeves. Sleeves in waterproofing membrane floors, bearing walls, and wet areas shall be galvanized steel pipe or cast-iron pipe. Sleeves in nonbearing walls, floors, or ceilings may be galvanized steel pipe, cast-iron pipe, or galvanized sheet metal with lock-type longitudinal seam. Except in pipe chases or interior walls, the annular space between pipe and sleeve or between jacket over insulation and sleeve in nonfire rated walls shall be sealed as indicated and specified in Section 07920 JOINT SEALING. Metal jackets shall be provided over insulation passing through exterior walls, firewalls, fire partitions, floors, or roofs.

Metal jackets shall not be thinner than 0.006 inch thick aluminum, if corrugated, and 0.016 inch thick aluminum, if smooth.

Metal jackets shall be secured with aluminum or stainless steel bands not less than 3/8 inch wide and not more than 8 inches apart. When penetrating roofs and before fitting the metal jacket into place, a 1/2 inch wide strip of sealant shall be run vertically along the inside of the longitudinal joint of the metal jacket from a point below the backup material to a minimum height of 36 inches above the roof. If the pipe turns from vertical to horizontal, the sealant strip shall be run to a point just beyond the first elbow. When penetrating waterproofing membrane for floors, the metal jacket shall extend from a point below the back-up material to a minimum distance of 2 inches above the flashing. For other areas, the metal jacket shall extend from a point below the backup material to a point 12 inches above material to a minimum distance of 2 inches above the flashing. For other areas, the metal jacket shall extend from a point below the backup material to a point 12 inches above the floor; when passing through walls above grade, the jacket shall extend at least 4 inches beyond each side of the wall.

#### **3.2.12.1 Fire Seal**

Where pipes pass through firewalls, fire partitions, or floors, a fire seal shall be provided as specified in Section 07270 FIRESTOPPING.

### **3.2.13 Balancing Valves**

Balancing valves shall be installed as required to allow balancing of the piping systems.

### **3.2.14 Thermometer Wells**

A thermometer well shall be provided in each return line for each circuit in multicircuit systems.

### **3.2.15 Air Vents**

Air vents shall be installed where shown or required. Air vents shall be installed in piping at all system high points. The vent shall remain open until water rises in the tank or pipe to a predetermined level at which time it shall close tight. An overflow pipe from the vent shall be run to a point designated by the Contracting Officer's representative. The inlet to the air vent shall have a gate valve or ball valve.

### **3.2.16 Escutcheons**

Escutcheons shall be provided at all finished surfaces where exposed piping, bare or insulated, passes through floors, walls, or ceilings except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be chromium-plated iron or chromium-plated brass, either one-piece or split pattern, held in place by internal spring tension or setscrews.

### **3.2.17 Drains**

A drain connection with a 1 inch gate valve or 3/4 inch hose bib shall be installed at the lowest point in the return main near the boiler. In addition, threaded drain connections with threaded cap or plug shall be installed on the heat exchanger coil on each unit heater or unit ventilator and wherever required for thorough draining of the system.

### **3.2.18 Strainer Blow-Down Piping**

Strainer blow-down connections shall be fitted with a black steel blow-down pipeline routed to an accessible location and provided with a blow-down valve.

## **3.3 GAS FUEL SYSTEM**

Gas piping, fittings, valves, regulators, tests, cleaning, and adjustments shall be in accordance with the Section 15488 GAS PIPING SYSTEMS. NFPA 54 shall be complied with unless otherwise specified. Burners, pilots, and all accessories shall be listed in UL-06. The fuel system shall be provided with a gas tight, manually operated, UL listed stop valve at the gas-supply connections, a gas strainer, a pressure regulator, pressure gauges, a burner-control valve, a safety shutoff valve suitable for size of burner and sequence of operation, and other components required for safe, efficient, and reliable operation as specified. Approved permanent and ready facilities to permit periodic valve leakage tests on the safety shutoff valve or valves shall be provided.

## **3.4 FIELD PAINTING**

Ferrous metal not specified to be coated at the factory shall be cleaned, prepared, and painted as specified in Section 09900 PAINTING, GENERAL. Exposed pipe covering shall be painted as specified in Section 09900 PAINTING, GENERAL. Aluminum sheath over insulation shall not be painted.

## **3.5 PIPING SYSTEM TESTS**

Before any covering is installed on pipe or heating equipment, the entire heating system's piping, fittings, and terminal heating units shall be

hydrostatically tested and proved tight at a pressure of 1-1/2 times the design working pressure. Before pressurizing system for test, items or equipment (e.g., vessels, pumps, instruments, controls, relief valves) rated for pressures below the test pressure shall be blanked off or replaced with spool pieces. Before balancing and final operating test, test blanks and spool pieces shall be removed; and protected instruments and equipment shall be reconnected. With equipment items protected, the system shall be pressurized to test pressure. Pressure shall be held for a period of time sufficient to inspect all welds, joints, and connections for leaks, but not less than 2 hours. No loss of pressure will be allowed. Leaks shall be repaired and repaired joints shall be retested. Caulking of joints shall not be permitted. System shall be drained and after instruments and equipment are reconnected, the system shall be refilled with service medium and maximum operating pressure applied. The pressure shall be held while inspecting these joints and connections for leaks. The leaks shall be repaired and the repaired joints retested. Upon completion of hydrostatic tests and before acceptance of the installation, the Contractor shall balance the heating system in accordance with Section 15990 TESTING, ADJUSTING AND BALANCING OF HVAC SYSTEMS; and operating tests required to demonstrate satisfactory functional and operational efficiency shall be performed. The operating test shall cover a period of at least 24 hours for each system, and shall include, as a minimum, the following specific information in a report, together with conclusions as to the adequacy of the system:

- a. Certification of balancing.
- b. Time, date, and duration of test.
- c. Outside and inside dry bulb temperatures.
- d. Temperature of hot water supply leaving boiler.
- e. Temperature of heating return water from system at boiler inlet.
- f. Boiler make, type, serial number, design pressure, and rated capacity.
- g. Dual temperature and boiler pump make, model, and rated capacity, and ammeter and voltmeter readings for pump motor during operation.
- h. Flue-gas temperature at boiler outlet.
- i. Quantity of water circulated.

Indicating instruments shall be read at half-hour intervals unless otherwise directed. The Contractor shall furnish all instruments, equipment, and personnel required for the tests and balancing.

### **3.6 CLEANING**

#### **3.6.1 Equipment**

Inside space heating equipment, and casing shall be thoroughly cleaned of debris and blown free of small particles of rubbish and dust and then vacuum cleaned before installing outlet faces. Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

### **3.7 FIELD TRAINING**

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 24 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The field instructions shall cover all of the items contained in the operating and maintenance instructions, as well as demonstrations of routine maintenance operations and boiler safety devices. The Contracting Officer shall be notified at least 14 days prior to date of proposed conduction of the training course.

--End of Section--

## SECTION 15895

### AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM

#### PART 1 GENERAL

##### 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

##### AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 350	(1986) Sound Rating of Non-Ducted Indoor Air-Conditioning Equipment
ARI 410	(1991) Forced-Circulation Air-Cooling and Air-Heating Coils
ARI 430	(1989) Central-Station Air-Handling Units
ARI 440	(1989) Room Fan-Coil Air-Conditioners
ARI Guideline D	(1987) Application and Installation of Central Station Air-Handling Units

##### AIR DIFFUSION COUNCIL (ADC)

ADC 1062:GRD	(1984) Test Codes for Grilles, Registers and Diffusers
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##### AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 210	(1985) Laboratory Methods of Testing Fans for Rating
AMCA 300	(1994) Reverberant Room Method for Sound Testing of Fans

##### AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABEMA)

ABEMA 9	(1990) Load Ratings and Fatigue Life for Ball Bearings
ABEMA 11	(1990) Load Ratings and Fatigue Life for Roller Bearings

##### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	(1993a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 123	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 525	(1993) General Requirement for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM B 117	(1994) Salt Spray (Fog) Testing
ASTM C 107	(1989) Panel Spalling Testing High-Duty Fireclay Brick
ASTM C 916	(1985; Rev 1990) Adhesives for Duct Thermal Insulation
ASTM C 1071	(1991) Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material)

ASTM D 520            (!984; R 1989) Zinc Dust Pigment

ASTM D 1654           (1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

ASTM D 3359           (1993) Measuring Adhesion by Tape Test

ASTM E 437            (1992) Industrial Wire Cloth and Screens (Square Opening Series)

ASTM E 84             (1994) Surface Burning Characteristics of Building Materials

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 15             (1992) Safety Code for Mechanical Refrigeration

ASHRAE 52.1           (1992) Gravimetric and Duct-Spot Procedures for Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter

ASHRAE 68             (1986) Laboratory Method of Testing In-Duct Sound Power Measurement Procedures for Fans

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1419           (Rev D) Filter Element, Air Conditioning (Viscous-Impingement and Dry Types, Replaceable)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1             (1993) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A              (1993) Installation of Air Conditioning and Ventilating Systems

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA-05             (1992) Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems

SMACNA-06             (1985) HVAC Duct Construction Standards - Metal and Flexible

UNDERWRITERS LABORATORIES (UL)

UL-03                  (1994) Electrical Construction Materials Directory

UL-05                  (1994; Supple) Fire Resistance Directory

UL 555                 (1990; Rev thru Nov 1993) Fire Dampers

UL 586                 (1990) High-Efficiency, Particulate, Air Filter Units

UL 723                 (1993; Rev Apr 1994) Test for Surface Burning Characteristics of Building Materials

UL 900                 (1994) Test Performance of Air Filter Units



## **1.2 COORDINATION OF TRADES**

Ductwork, piping offsets, fittings, and accessories shall be furnished as required to provide a complete installation and to eliminate interference with other construction.

## **1.3 DELIVERY AND STORAGE**

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

# **PART 2 PRODUCTS**

## **2.1 STANDARD PRODUCTS**

Components and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of products that are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years before bid opening. The 2-year experience shall include applications of components and equipment under similar circumstances and of similar size. The 2 years must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. The equipment items shall be supported by a service organization.

## **2.2 ASBESTOS PROHIBITION**

Asbestos and asbestos-containing products shall not be used.

## **2.3 NAMEPLATES**

Equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

## **2.4 EQUIPMENT GUARDS AND ACCESS**

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact shall be fully enclosed or guarded according to OSHA requirements. High temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard shall be properly guarded or covered with insulation of a type specified.

## **2.5 PIPING COMPONENTS**

All piping components shall be as specified in Section 15569: WATER HEATING, GAS, UP TO 20 MBTUH.

### **2.5.1 Insulation**

Shop and field applied insulation shall be as specified in Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

### **2.5.2 Condensate Drain Lines**

Condensate drainage shall be provided for each item of equipment that generates condensate as specified for drain, waste, and vent piping systems in Section 15400 PLUMBING, GENERAL PURPOSE.

## **2.6 ELECTRICAL WORK**

Electrical motor-driven equipment specified shall be provided complete with motor, motor starter, and controls. Unless otherwise specified, electric equipment, including wiring and motor efficiencies, shall be according to Section 16415 ELECTRICAL WORK, INTERIOR. Electrical characteristics and enclosure type shall be as shown. Unless otherwise indicated, motors of 1 hp and above shall be high efficiency type. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary. Each motor shall be according to NEMA MG 1 and shall be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices, but not shown, shall be provided.

## **2.7 CONTROLS**

Except for room fan coil unit controls, controls shall be provided as specified in Section 15950 HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS. Room fan coil unit controls are specified herein.

## **2.8 DUCTWORK COMPONENTS**

### **2.8.1 Metal Ductwork**

All aspects of metal ductwork construction, including all fittings and components, shall comply with SMACNA-06 unless otherwise specified. Elbows shall be radius type with a centerline radius of 1-1/2 times the width or diameter of the duct where space permits. Otherwise, elbows having a minimum radius equal to the width or diameter of the duct or square elbows with factory fabricated turning vanes may be used. Static pressure Class 1/2, 1, and 2 inch w.g. ductwork shall meet the requirements of Seal Class C. Sealants shall conform to fire hazard classification specified in Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Pressure sensitive tape shall not be used as a sealant. Spiral lock seam duct, and flat oval shall be made with duct sealant and locked with not less than 3 equally spaced drive screws or other approved methods indicated in SMACNA-06. The sealant shall be applied to the exposed male part of the fitting collar so that the sealer will be on the inside of the joint and fully protected by the metal of the duct fitting. One brush coat of the sealant shall be applied over the outside of the joint to at least 2 inch band width covering all screw heads and joint gap. Dents in the male portion of the slip fitting collar will not be acceptable. Outdoor air intake ducts and plenums shall be fabricated with watertight soldered or brazed joints and seams.

#### **2.8.1.1 Transitions**

Diverging air flow transitions shall be made with each side pitched out a maximum of 15 degrees, for an included angle of 30 degrees. Transitions for converging air flow shall be made with each side pitched in a maximum of 30 degrees, for an included angle of 60 degrees, or shall be as indicated. Factory-fabricated reducing fittings for systems using round duct sections when formed to the shape of the ASME short flow nozzle, need not comply with the maximum angles specified.

#### **2.8.1.2 Flexible Duct**

Use of flexible duct will not be allowed.

#### **2.8.1.3 General Service Duct Connectors**

A flexible duct connector approximately 6 inches in width shall be provided where sheet metal connections are made to fans or where ducts of dissimilar metals are connected. For round/oval ducts, the flexible material shall be secured by stainless steel or zinc-coated, iron clinch-type draw bands. For rectangular ducts, the flexible material locked to metal collars shall be installed using normal duct construction methods. The composite connector system shall comply with UL 214 and be classified as "flame-retarded fabrics" in UL-01.

### **2.8.2 Ductwork Accessories**

#### **2.8.2.1 Duct Access Doors**

Access doors shall be provided in ductwork and plenums where required for maintenance and at all air flow measuring primaries, automatic dampers, fire dampers, coils, thermostats, and other apparatus requiring service and inspection in the duct system, and unless otherwise shown, shall conform to SMACNA-06. Access doors shall be provided upstream and downstream of air flow measuring primaries and heating and cooling coils. Doors shall be minimum 15 by 18 inches, unless otherwise shown. Where duct size will not accommodate this size door, the doors shall be made as large as practicable. Doors 24 by 24 inches or larger shall be provided with fasteners operable from both sides. Doors in insulated ducts shall be the insulated type.

#### **2.8.2.2 Fire Dampers**

Fire dampers shall be 1-1/2 hour fire rated unless otherwise indicated. Fire dampers shall conform to the requirements of NFPA 90A and UL 555. Fire dampers shall be automatic operating type and shall have a dynamic rating suitable for the maximum air velocity and pressure differential to which it will be subjected. Fire dampers shall be approved for the specific application, and shall be installed according to their listing. Fire dampers shall be equipped with a steel sleeve or adequately sized frame installed in such a manner that disruption of the attached ductwork, if any, will not impair the operation of the damper. Sleeves or frames shall be equipped with perimeter mounting angles attached on both sides of the wall or floor opening. Ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce the ceiling of the assemblies shall be constructed in conformance with UL-05. Fire dampers shall be curtain type with damper blades out of the air stream. Dampers shall not reduce the duct or the air transfer opening cross-sectional area. Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition or floor slab depth or thickness. Unless otherwise indicated, the installation details given in SMACNA-05 and in manufacturer's instructions for fire dampers shall be followed.

#### **2.8.2.3 Splitters and Manual Balancing Dampers**

Splitters and manual balancing dampers shall be furnished with accessible operating mechanisms. Where operators occur in finished portions of the building, operators shall be chromium plated with all exposed edges rounded. Splitters shall be operated by quadrant operators or 3/16 inch rod brought through the side of the duct with locking setscrew and bushing. Two rods are

required on splitters over 8 inches. Manual volume control dampers shall be operated by locking-type quadrant operators. Dampers and splitters shall be 2 gauges heavier than the duct in which installed. Unless otherwise indicated, multileaf dampers shall be opposed blade type with maximum blade width of 12 inches. Access doors or panels shall be provided for all concealed damper operators and locking setscrews. Unless otherwise indicated, the locking-type quadrant operators for dampers, when installed on ducts to be thermally insulated, shall be provided with stand-off mounting brackets, bases, or adapters to provide clearance between the duct surface and the operator not less than the thickness of the insulation. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer. Volume dampers shall be provided where indicated.

#### **2.8.2.4 Air Deflectors and Branch Connections**

Air deflectors shall be provided at duct mounted supply outlets, at takeoff or extension collars to supply outlets, at duct branch takeoff connections, and at 90 degree elbows, as well as at locations as indicated on the drawings or otherwise specified. Conical branch connections or 45 degree entry connections may be used in lieu of deflectors or extractors for branch connections. All air deflectors, except those installed in 90 degree elbows, shall be provided with an approved means of adjustment. Adjustment shall be made from easily accessible means inside the duct or from an adjustment with sturdy lock on the face of the duct. When installed on ducts to be thermally insulated, external adjustments shall be provided with stand-off mounting brackets, integral with the adjustment device, to provide clearance between the duct surface and the adjustment device not less than the thickness of the thermal insulation. Air deflectors shall be factory-fabricated units consisting of curved turning vanes or louver blades designed to provide uniform air distribution and change of direction with minimum turbulence or pressure loss. Air deflectors shall be factory or field assembled. Blade air deflectors, also called blade air extractors, shall be approved factory fabricated units consisting of equalizing grid and adjustable blade and lock. Adjustment shall be easily made from the face of the diffuser or by position adjustment and lock external to the duct. Stand-off brackets shall be provided on insulated ducts and are described herein. Fixed air deflectors, also called turning vanes, shall be provided in 90 degree elbows.

#### **2.8.3 Duct Sleeves, Framed Prepared Openings, Closure Collars**

##### **2.8.3.1 Duct Sleeves**

Duct sleeves shall be provided for round ducts 15 inches in diameter or less passing through floors, walls, ceilings, or roof, and installed during construction of the floor, wall, ceiling, or roof. Round ducts larger than 15 inches in diameter and square, rectangular, and oval ducts passing through floors, walls, ceilings, or roof shall be installed through framed prepared openings. The Contractor shall be responsible for the proper size and location of sleeves and prepared openings. Sleeves and framed openings are also required where grilles, registers, and diffusers are installed at the openings. Framed prepared openings shall be fabricated from 20 gauge galvanized steel, unless otherwise indicated. Where sleeves are installed in bearing walls or partitions, black steel pipe, ASTM A 53, Schedule 20 shall be used. Sleeve shall provide 1 inch clearance between the duct and the sleeve or 1 inch clearance between the insulation and the sleeve for insulated ducts.

##### **2.8.3.2 Framed Prepared Openings**

Openings shall have 1 inch clearance between the duct and the opening or 1 inch clearance between the insulation and the opening for insulated ducts.

### **2.8.3.3 Closure Collars**

Collars shall be fabricated of galvanized sheet metal not less than 4 inches wide, unless otherwise indicated, and shall be installed on exposed ducts on each side of walls or floors where sleeves or prepared openings are provided. Collars shall be installed tight against surfaces. Collars shall fit snugly around the duct or insulation. Sharp edges of the collar around insulated duct shall be ground smooth to preclude tearing or puncturing the insulation covering or vapor barrier. Collars for round ducts 15 inches in diameter or less shall be fabricated from 20 gauge galvanized steel. Collars for round ducts larger than 15 inches and square, and rectangular ducts shall be fabricated from 18 gauge galvanized steel. Collars shall be installed with fasteners on maximum 6 inch centers, except that not less than 4 fasteners shall be used.

### **2.8.3.4 Duct Liner**

Unless otherwise specified, duct liner shall conform to ASTM C 1071, Type I or II.

### **2.8.4 Sound Attenuation Equipment**

#### **a. Acoustical Duct Liner:**

Acoustical duct lining shall be fibrous glass designed exclusively for lining ductwork and shall conform to the requirements of ASTM C 1071, Type I and II. Liner composition may be uniform density, graduated density, or dual density, as standard with the manufacturer. Lining shall be coated, not less than 1 inch thick. Where acoustical duct liner is used, liner or combination of liner and insulation applied to the exterior of the ductwork shall be the thermal equivalent of the insulation specified in Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Duct sizes shown shall be increased to compensate for the thickness of the lining used. In lieu of sheet metal duct with field-applied acoustical lining, acoustically equivalent lengths of fibrous glass duct or factory fabricated double-walled internally insulated duct with perforated liner may be provided. Net insertion loss value, static pressure drop, and air flow velocity capacity data shall be certified by a nationally recognized independent acoustical laboratory.

### **2.8.5 Diffusers, Registers, and Grilles**

Units shall be factory-fabricated of steel, corrosion-resistant steel, or aluminum and shall distribute the specified quantity of air evenly over space intended without causing noticeable drafts, air movement faster than 50 fpm in occupied zone, or dead spots anywhere in the conditioned area. Outlets for diffusion, spread, throw, and noise level shall be as required for specified performance. Performance shall be certified according to ADC 1062:GRD. Inlets and outlets shall be sound rated and certified according to ADC 1062:GRD. Sound power level shall be as indicated. Diffusers and registers shall be provided with volume damper with accessible operator, unless otherwise indicated; or if standard with the manufacturer, an automatically controlled device will be acceptable. Volume dampers shall be opposed blade type for all diffusers and registers, except linear slot diffusers. Linear slot diffusers shall be provided with round or elliptical balancing dampers. Where the inlet and outlet openings are located less than 7 feet above the floor, they shall be protected by a grille or screen according to NFPA 90A.

#### **2.8.5.1 Diffusers**

Diffuser types shall be as indicated. Ceiling mounted units shall be furnished with anti-smudge devices, unless the diffuser unit minimizes ceiling

smudging through design features. Diffusers shall be provided with air deflectors of the type indicated. Air handling troffers or combination light and ceiling diffusers shall conform to the requirements of UL-03 for the interchangeable use as cooled or heated air supply diffusers or return air units. Ceiling mounted units shall be installed with rims tight against ceiling. Sponge rubber gaskets shall be provided between ceiling and surface mounted diffusers for air leakage control. Suitable trim shall be provided for flush mounted diffusers. Duct collar connecting the duct to diffuser shall be airtight and shall not interfere with volume controller. Return or exhaust units shall be similar to supply diffusers.

#### **2.8.5.2 Registers and Grilles**

Units shall be four-way directional-control type, except that return and exhaust registers may be fixed horizontal or vertical louver type similar in appearance to the supply register face. Registers shall be provided with sponge-rubber gasket between flanges and wall or ceiling. Wall supply registers shall be installed at least 6 inches below the ceiling unless otherwise indicated. Return and exhaust registers shall be 6 inches above the floor unless otherwise indicated. Four-way directional control may be achieved by a grille face which can be rotated in 4 positions or by adjustment of horizontal and vertical vanes. Grilles shall be as specified for registers, without volume control damper.

#### **2.8.6 Louvers**

Louvers for installation in exterior walls which are associated with the air supply and distribution system shall be as specified in Section 07600 SHEET METALWORK, GENERAL.

#### **2.8.7 Bird Screens and Frames**

Bird screens shall conform to ASTM E 437, Type I, Class 1, 2 by 2 mesh, 0.063 inch diameter aluminum wire or 0.031 inch diameter stainless steel wire. Frames shall be removable type or stainless steel or extruded aluminum.

### **2.9 AIR SYSTEMS EQUIPMENT**

#### **2.9.1 Fans**

Fans shall be tested and rated according to AMCA 210. Fans may be connected to the motors either directly or indirectly with V-belt drive. V-belt drives shall be designed for not less than 150 percent of the connected driving capacity. Motor sheaves shall be variable pitch for 15 hp and below and fixed pitch as defined by ARI Guideline D. Variable pitch sheaves shall be selected to drive the fan at a speed which will produce the specified capacity when set at the approximate midpoint of the sheave adjustment. When fixed pitch sheaves are furnished, a replaceable sheave shall be provided when needed to achieve system air balance. Motors for V-belt drives shall be provided with adjustable rails or bases. Removable metal guards shall be provided for all exposed V-belt drives, and speed-test openings shall be provided at the center of all rotating shafts. Fans shall be provided with personnel screens or guards on both suction and supply ends, except that the screens need not be provided, unless otherwise indicated, where ducts are connected to the fan. Fan and motor assemblies shall be provided with vibration-isolation supports or mountings as indicated. Vibration-isolation units shall be standard products with published loading ratings. Each fan shall be selected to produce the capacity required at the fan static pressure indicated. Sound power level shall be as indicated. The sound power level values shall be obtained according to AMCA 300. Standard AMCA arrangement, rotation, and discharge shall be as indicated. Provide weather resistant enclosure on starters for roof mounted fans.

#### **2.9.1.1 Centrifugal Fans**

Centrifugal fans shall be fully enclosed, single-width single-inlet, or double-width double-inlet, AMCA Pressure Class I, II, or III as required or indicated for the design system pressure. Impeller wheels shall be rigidly constructed, accurately balanced both statically and dynamically. Fan blades may be forward curved, backward-inclined or airfoil design in wheel sizes up to 30 inches. Fan blades for wheels over 30 inches in diameter shall be backward-inclined or airfoil design. Fan wheels over 36 inches in diameter shall have overhung pulleys and a bearing on each side of the wheel. Fan wheels 36 inches or less in diameter may have one or more extra long bearings between the fan wheel and the drive. Bearings shall be sleeve type, self-aligning and self-oiling with oil reservoirs, or precision self-aligning roller or ball-type with accessible grease fittings or permanently lubricated type. Grease fittings shall be connected to tubing and serviceable from a single accessible point. Bearing life shall be L50 rated at not less than 200,000 hours as defined by ABEMA 9 and ABEMA 11. Fan shafts shall be steel, accurately finished, and shall be provided with key seats and keys for impeller hubs and fan pulleys. Each fan outlet shall be of ample proportions and shall be designed for the attachment of angles and bolts for attaching flexible connections. Motors, unless otherwise indicated, shall not exceed 1800 rpm and shall have open dripproof enclosures. Motor starters shall be across-the-line type with general-purpose enclosure.

#### **2.9.1.2 In-Line Centrifugal Fans**

In-line fans shall have centrifugal backward inclined blades, stationary discharge conversion vanes, internal and external belt guards, and adjustable motor mounts. Fans shall be mounted in a welded tubular casing. Air shall enter and leave the fan axially. Inlets shall be streamlined with conversion vanes to eliminate turbulence and provide smooth discharge air flow. Fan bearings and drive shafts shall be enclosed and isolated from the air stream. Fan bearings shall be sealed against dust and dirt and shall be permanently lubricated, and shall be precision self aligning ball or roller type. Bearing life shall be L50 rated at not less than 200,000 hours as defined by ABEMA 9 and ABEMA 11. Motors shall have open dripproof enclosure. Motor starters shall be across-the-line with general-purpose enclosures.

#### **2.9.1.3 Axial Flow Fans**

Axial flow fans shall be complete with drive components and belt guard, and shall have a steel housing, cast fan wheel, cast or welded steel diffusers, fan shaft, bearings, and mounting frame as a factory-assembled unit. Fan wheels shall have radially projecting blades of airfoil cross section and shall be dynamically balanced and keyed to the fan shaft. Fan bearings and drive shafts shall be enclosed and isolated from the air stream. Fan bearings shall be sealed against dust and dirt, shall be permanently lubricated or with accessible grease fittings, and shall be precision self-aligning ball or roller type. Bearing life shall be L50 rated at not less than 200,000 hours of operation as defined by ABEMA 9 and ABEMA 11. Fan inlets shall be provided with an aerodynamically shaped bell and an inlet cone. Diffuser or straightening vanes shall be provided at the fan discharge to minimize turbulence and provide smooth discharge air flow. Fan unit shall be provided with inlet screen. Unless otherwise indicated, motors shall not exceed 1800 rpm and shall have open dripproof enclosure. Motor starters shall be magnetic across-the-line with general-purpose enclosure.

#### **2.9.1.4 Centrifugal Type Power Roof Ventilators**

Fans shall be V-belt driven with backward inclined, non-overloading wheel. Motor compartment housing shall be hinged or removable and weatherproof, constructed of heavy gauge aluminum. Fans shall be provided with birdscreen, disconnect switch, gravity dampers, roof curb, and extended base. Motors enclosure shall be dripproof type.

#### **2.9.2 Coils**

Coils shall be fin-and-tube type constructed of seamless copper tubes and copper fins mechanically bonded or soldered to the tubes. Copper tube wall thickness shall be a minimum of 0.024 inches. Copper fins shall be 0.0045 inch minimum thickness. Casing and tube support sheets shall be not lighter than 16 gauge galvanized steel, formed to provide structural strength. When required, multiple tube supports shall be provided to prevent tube sag. Each coil shall be tested at the factory under water at not less than 400 psi air pressure and shall be suitable for 200 psi working pressure. Coils shall be mounted for counterflow service. Coils shall be rated and certified according to ARI 410.

##### **2.9.2.1 Water Coils**

Water coils shall be installed with a pitch of not less than 1/8 inch per foot of the tube length toward the drain end. Headers shall be constructed of cast iron, welded steel or copper. Each coil shall be provided with a plugged vent and drain connection extending through the unit casing.

##### **2.9.3 Air Filters**

Air filters shall be listed according to requirements of UL 900, except high efficiency particulate air filters of 99.97 percent efficiency by the DOP Test method shall be as listed under the Label Service and shall meet the requirements of UL 586.

##### **2.9.3.1 Extended Surface Pleated Panel Filters**

Filters shall be 2 inch depth, sectional, disposable type of the size required for 500 FPM maximum velocity and shall have an average efficiency of 25 to 30 percent when tested according to ASHRAE 52.1. Initial resistance at 500 feet per minute shall not exceed 0.36 inches water gauge. Filters shall be UL Class 2. Media shall be nonwoven cotton and synthetic fiber mat. A wire support grid bonded to the media shall be attached to a moisture resistant fiberboard frame. All four edges of the filter media shall be bonded to the inside of the frame to prevent air bypass and increase rigidity.

##### **2.9.3.2 Holding Frames for Make-Up Air Systems**

Frames shall be fabricated from not lighter than 16 gauge sheet steel with rust-inhibitor coating. Each holding frame shall be equipped with suitable filter holding devices. Holding frame seats shall be gasketed. All joints shall be airtight.

##### **2.9.3.3 Filter Gauges for Make-Up Air Systems**

Filter gauges shall be dial type, diaphragm actuated draft and shall be provided for all filter stations, including those filters which are furnished as integral parts of factory fabricated air handling units. Gauges shall be at least 3-7/8 inches in diameter, shall have white dials with black figures, and shall be graduated in 0.01 inch, and shall have a minimum range of 1 inch beyond the specified final resistance for the filter bank on which each gauge is applied. Each gauge shall incorporate a screw operated zero adjustment and



shall be furnished complete with two static pressure tips with integral compression fittings, two molded plastic vent valves, two 5 foot minimum lengths of 1/4 inch diameter aluminum tubing, and all hardware and accessories for gauge mounting.

## **2.10 AIR HANDLING UNITS**

### **2.10.1 Factory-Fabricated Make-Up Air Handling Units**

Units shall be single-zone draw-through type. Units shall include fans, coils, airtight insulated casing, prefilters, adjustable V-belt drives, belt guards for externally mounted motors, access sections where indicated, combination sectional filter-mixing box, vibration-isolators, run around heat-pipe sections and appurtenances required for specified operation. Vibration isolators shall be as indicated. Each air handling unit shall have physical dimensions suitable to fit space allotted to the unit and shall have the capacity indicated. Air handling unit shall have published ratings based on tests performed according to ARI 430.

#### **2.10.1.1 Casings**

Casing sections shall be 2 inch double wall type constructed of a minimum 18 gauge galvanized steel, or 18 gauge steel outer casing protected with a corrosion resistant paint finish according to paragraph FACTORY PAINTING. Inner casing of double-wall units shall be minimum 20 gauge solid galvanized steel. Casing shall be designed and constructed with an integral structural steel frame such that exterior panels are non-load bearing. Exterior panels shall be individually removable. Removal shall not affect the structural integrity of the unit. Casings shall be provided with inspection doors, access sections, and access doors as indicated. Inspection and access doors shall be insulated, fully gasketed, double-wall type, of a minimum 18 gauge outer and 20 gauge inner panels. Doors shall be rigid and provided with heavy duty hinges and latches. Inspection doors shall be a minimum 12 inches wide by 12 inches high. Access doors shall be minimum 24 inches wide and shall be the full height of the unit casing or a minimum of 6 ft., whichever is less. Access Sections shall be according to paragraph AIR HANDLING UNITS. Drain pan shall be double-bottom type constructed of 16 gauge stainless steel, pitched to the drain connection. Drain pans shall be constructed water tight, treated to prevent corrosion, and designed for positive condensate drainage. When 2 or more cooling coils are used, with one stacked above the other, condensate from the upper coils shall not flow across the face of lower coils. Intermediate drain pans or condensate collection channels and downspouts shall be provided, as required to carry condensate to the unit drain pan out of the air stream and without moisture carryover. Each casing section handling conditioned air shall be insulated with not less than 1 inch thick, 1-1/2 pound density coated fibrous glass material having a thermal conductivity not greater than 0.23 Btu/hr-sf-F. Factory applied fibrous glass insulation shall conform to ASTM C 1071, except that the minimum thickness and density requirements do not apply, and shall meet the requirements of NFPA 90A. Foam-type insulation is not acceptable. Foil-faced insulation shall not be an acceptable substitute for use on double-wall access doors and inspections doors and casing sections. Duct liner material, coating, and adhesive shall conform to fire-hazard requirements specified in Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Exposed insulation edges and joints where insulation panels are butted together shall be protected with a metal nosing strip or shall be coated to conform to meet erosion resistance requirements of ASTM C 107. A latched and hinged inspection door, shall be provided in the fan and coil sections.

#### **2.10.1.2 Heating and Cooling Coils**

Coils shall be provided as specified in paragraph AIR SYSTEMS EQUIPMENT, for types indicated.

#### **2.10.1.3 Air Filters**

Air filters shall be as specified in paragraph AIR SYSTEMS EQUIPMENT for types and thickness indicated.

#### **2.10.1.4 Fans**

Fans shall be double-inlet, centrifugal type with each fan in a separate scroll. Fans and shafts shall be dynamically balanced prior to installation into air handling unit, then the entire fan assembly shall be statically and dynamically balanced at the factory after it has been installed in the air handling unit. Fans shall be mounted on steel shafts accurately ground and finished. Fan bearings shall be sealed against dust and dirt and shall be precision self-aligning ball or roller type. Bearing life shall be L50 rated at not less than 200,000 hours as defined by ABEMA 9 and ABEMA 11. Bearings shall be permanently lubricated or lubricated type with lubrication fittings readily accessible at the drive side of the unit. Bearings shall be supported by structural shapes, or die formed sheet structural members, or support plates securely attached to the unit casing. Bearings may not be fastened directly to the unit sheet metal casing. Fans and scrolls shall be furnished with coating indicated. Fans shall be driven by a unit-mounted or a floor-mounted motor connected to fans by V-belt drive complete with belt guard for externally mounted motors. Belt guards shall be the three sided enclosed type with solid or expanded metal face. Belt drives shall be designed for not less than a 1.3 service factor based on motor nameplate rating. Motor sheaves shall be variable pitch for 25 hp and below and fixed pitch above 25 hp as defined by ARI Guideline D. Where fixed sheaves are required, variable pitch sheaves may be used during air balance, but shall be replaced with an appropriate fixed sheave after air balance is completed. Variable pitch sheaves shall be selected to drive the fan at a speed that will produce the specified capacity when set at the approximate midpoint of the sheave adjustment. Motors for V-belt drives shall be provided with adjustable bases. Fan motors shall have open enclosures. Motor starters shall be magnetic across-the-line type with general-purpose enclosure. Unit fan or fans shall be selected to produce the required capacity at the fan static pressure. Sound power level shall be as indicated. The sound power level values shall be obtained according to AMCA 300 or ASHRAE 68.

#### **2.10.1.5 Access Sections and Filter/Mixing Boxes**

Access sections shall be provided where indicated and shall be furnished with access doors as shown. Access sections and filter/mixing boxes shall be constructed in a manner identical to the remainder of the unit casing and shall be equipped with access doors. Mixing boxes shall be designed to minimize air stratification and to promote thorough mixing of the air streams.

### **2.11 TERMINAL UNITS**

#### **2.11.1 Room Fan-Coil Units**

Base units shall include galvanized coil casing, coil assembly drain pan valve and piping package, air filter, fans, motor, fan drive, and motor switch, plus a concealed vertical apartment type for rooms or horizontal concealed enclosure elsewhere enclosure. Leveling devices integral with the unit shall be provided for vertical type units. Sound power levels shall be as indicated. Sound power level data or values for these units shall be obtained

according to test procedures based on ARI 350. Sound power values apply to units provided with factory fabricated cabinet enclosures and standard grilles. Values obtained for the standard cabinet models will be acceptable for concealed models without separate test provided there is no variation between models as to the coil configuration, blowers, motor speeds, or relative arrangement of parts. Automatic valves and controls shall be provided as specified in paragraph CONTROLS. Each unit shall be fastened securely to the building structure. Capacity of the units shall be as indicated. Room fan-coil units shall be certified as complying with ARI 440, and shall meet the requirements of UL 1995.

#### **2.11.1.1 Enclosures**

Enclosures shall be fabricated of not lighter than 18 gauge steel, reinforced and braced. Front panels of enclosures shall be removable and provided with 1/2 inch thick dual density fibrous glass insulation. The exposed side shall be high density, erosion-proof material suitable for use in air streams with velocities up to 4,500 fpm. Ferrous metal surfaces shall be galvanized or factory finished with corrosion resistant enamel. Access doors or removable panels shall be provided for piping and control compartments. Duct discharge collar shall be provided. Enclosures shall have easy access for filter replacement.

#### **2.11.1.2 Fans**

Fans shall be galvanized steel or aluminum, multiblade, centrifugal type. In lieu of metal, fans and scrolls may be non-metallic materials of suitably reinforced compounds. Fans shall be dynamically and statically balanced. Surfaces shall be smooth. Assemblies shall be accessible for maintenance. Disassembly and re-assembly shall be by means of mechanical fastening devices and not by epoxies or cements.

#### **2.11.1.3 Coils**

Coils shall be constructed of not less than 3/8 inch outside diameter seamless copper tubing, with copper or aluminum fins mechanically bonded or soldered to the tubes. Coils shall be provided with not less than 1/2 inch outside diameter flare or sweat connectors, accessory piping package with thermal connections suitable for connection to the type of control valve supplied, and manual air vent. Coils shall be tested hydrostatically at 300 psi or under water at 250 psi air pressure and suitable for 200 psi working pressure. Provisions shall be made for coil removal.

#### **2.11.1.4 Drain Pans**

Drain and drip pans shall be sized and located to collect all water condensed on and dripping from any item within the unit enclosure or casing. Drain pans shall be constructed of not lighter than 21 gauge steel, galvanized after fabrication, thermally insulated to prevent condensation. Insulation shall have a flame spread rating not over 25 without evidence of continued progressive combustion, a smoke developed rating no higher than 50, and shall be of a waterproof type or coated with a waterproofing material. In lieu of the above, drain pans may be constructed of die-formed 22 gauge steel, formed from a single sheet, galvanized after fabrication, insulated and coated as specified for the 21 gauge material or of die-formed 21 gauge type 304 stainless steel, insulated as specified above. Drain pans shall be pitched to drain. Minimum 3/4 inch NPT or 5/8 inch OD drain connection shall be provided in drain pan. Auxiliary drain pans to catch drips from control and piping packages, eliminating insulation of the packages, may be plastic; if metal, the auxiliary pans shall comply with the requirements specified above. Insulation at control and piping connections thereto shall extend 1 inch minimum over the auxiliary drain pan.

#### **2.11.1.5 Filters**

Filters shall be of the fiberglass disposable type, 1 inch thick, conforming to CID A-A-1419. Filters in each unit shall be removable without the use of tools.

#### **2.11.1.6 Motors**

Motors shall be of the permanent split-capacitor type with built-in thermal overload protection, directly connected to unit fans. Motors to be three speed type with fan speed controlled through thermostat controlled relays. Motors shall have permanently-lubricated or oilable sleeve-type or combination ball and sleeve-type bearings with vibration isolating mountings suitable for continuous duty. Motor power consumption, shown in watts, at the fan operating speed selected to meet the specified capacity shall not exceed the following values:

Unit Capacity (cfm)	Maximum Power Consumption (Watts)
200	55
300	60
400	65
600	80
800	130
1000	130
1200	130

#### **2.11.1.7 Dorm Room Fan coil Units**

Units shall be of the "hi-rise" or "apartment" style similar to Trane "Hi-Rise" series. Capacities to be certified in accordance with ARI 440. Units to include chassis, coil, 1-1/2 pound density fiberglass insulation, air blank-offs around coil, fan board, drain pan assembly, motor, junction box and filter. Unit to be provided with removable front panel having a factory applied baked enamel finish. Removal of front panel to allow access to coil, motor and fan. Fan/motor assembly to be slide-out design for easy replacement. Provide filter in the return air grille. provide 10 spare fan/motor assemblies.

### **2.12 ENERGY RECOVERY DEVICES**

#### **2.12.1 Heat Pipe**

Device shall be a factory fabricated, assembled and tested, counterflow arrangement, air-to-air heat exchanger for transfer of sensible heat between exhaust and supply streams without cross-contamination.

### **2.13 FACTORY PAINTING**

Units which are not of galvanized construction according to ASTM A 123 or ASTM A 525 shall be factory painted with a corrosion resisting paint finish. Internal and external ferrous metal surfaces shall be cleaned, phosphatised and coated with a paint finish which has been tested according to ASTM B 117, ASTM D 1654, and ASTM D 3359. Evidence of satisfactory paint performance for a minimum of 125 hours for units to be installed indoors and 500 hours for units to be installed outdoors shall be submitted. Rating of failure at the scribe mark shall be not less than 6, average creepage not greater 1/8 inch. Rating of the inscribed area shall not be less than 10, no failure. On units

constructed of galvanized steel which have been welded, exterior surfaces of welds or welds that have burned through from the interior shall receive a final shop docket of zinc-rich protective paint according to ASTM D 520 Type I.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

Work shall be installed as shown and according to the manufacturer's diagrams and recommendations.

#### **3.1.1 Piping**

Piping to be installed in accordance with Section 15569: WATER HEATING, GAS; UP TO 20 MBTUH.

#### **3.1.2 Equipment and Installation**

Frames and supports shall be provided for tanks, compressors, pumps, valves, air handling units, fans, coils, dampers, and other similar items requiring supports. Air handling units shall be floor mounted or ceiling hung, as indicated. The method of anchoring and fastening shall be as detailed. Floor-mounted equipment, unless otherwise indicated, shall be set on not less than 6 inch concrete pads or curbs doweled in place. Concrete foundations for circulating pumps shall be heavy enough to minimize the intensity of the vibrations transmitted to the piping and the surrounding structure, as recommended in writing by the pump manufacturer. In lieu of a concrete pad foundation, a concrete pedestal block with isolators placed between the pedestal block and the floor may be provided. The concrete foundation or concrete pedestal block shall be of a mass not less than three times the weight of the components to be supported. Lines connected to the pump mounted on pedestal blocks shall be provided with flexible connectors. Foundation drawings, bolt-setting information, and foundation bolts shall be furnished prior to concrete foundation construction for all equipment indicated or required to have concrete foundations. Concrete for foundations shall be as specified in Section 03300 CONCRETE FOR BUILDING CONSTRUCTION.

#### **3.1.3 Access Panels**

Access panels shall be provided for concealed valves, vents, controls, dampers, and items requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced and maintained or completely removed and replaced. Access panels shall be as specified in Section 05500 MISCELLANEOUS METALS.

#### **3.1.4 Flexible Connectors**

Pre-insulated flexible connectors and flexible duct shall be attached to other components in accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Hangers, when required to suspend the connectors, shall be of the type recommended by the connector or duct manufacturer and shall be provided at the intervals recommended.

#### **3.1.5 Sleeved and Framed Openings**

Space between the sleeved or framed opening and the duct or the duct insulation shall be packed as specified in Section 07270 FIRESTOPPING for fire rated penetrations. For non-fire rated penetrations, the space shall be packed as specified in Section 07920 JOINT SEALING.

### **3.1.6 Metal Ductwork**

Installation shall be according to SMACNA-06 unless otherwise indicated. Duct supports for sheet metal ductwork shall be according to SMACNA-06, unless otherwise specified. Friction beam clamps indicated in SMACNA-06 shall not be used. Risers on high velocity ducts shall be anchored in the center of the vertical run to allow ends of riser to move due to thermal expansion. Supports on the risers shall allow free vertical movement of the duct. Supports shall be attached only to structural framing members and concrete slabs. Supports shall not be anchored to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, suitable intermediate metal framing shall be provided. Where C-clamps are used, retainer clips shall be provided.

### **3.1.7 Acoustical Duct Lining**

Lining shall be applied in cut-to-size pieces attached to the interior of the duct with nonflammable fire resistant adhesive conforming to ASTM C 916, Type I, NFPA 90A, UL 723, and ASTM E 84. Top and bottom pieces shall lap the side pieces and shall be secured with welded pins, adhered clips of metal, nylon, or high impact plastic, and speed washers or welding cup-head pins installed according to SMACNA-06. Welded pins, cup-head pins, or adhered clips shall not distort the duct, burn through, nor mar the finish or the surface of the duct. Pins and washers shall be flush with the surfaces of the duct liner and all breaks and punctures of the duct liner coating shall be sealed with the nonflammable, fire resistant adhesive. Exposed edges of the liner at the duct ends and at other joints where the lining will be subject to erosion shall be coated with a heavy brush coat of the nonflammable, fire resistant adhesive, to prevent delamination of glass fibers. Duct liner may be applied to flat sheet metal prior to forming duct through the sheet metal brake. Lining at the top and bottom surfaces of the duct shall be additionally secured by welded pins or adhered clips as specified for cut-to-size pieces. Other methods indicated in SMACNA-06 to obtain proper installation of duct liners in sheet metal ducts, including adhesives and fasteners, will be acceptable.

### **3.1.8 Dust Control**

To prevent the accumulation of dust, debris and foreign material during construction, temporary dust control protection shall be provided. The distribution system (supply and return) shall be protected with temporary seal-offs at all inlets and outlets at the end of each day's work. Temporary protection shall remain in place until system is ready for startup.

### **3.1.9 Insulation**

Thickness and application of insulation materials for ductwork, piping, and equipment shall be according to Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Outdoor air intake ducts and plenums shall be externally insulated up to the point where the outdoor air reaches the conditioning unit.

### **3.1.10 Duct Test Holes**

Holes with closures or threaded holes with plugs shall be provided in ducts and plenums as indicated or where necessary for the use of pitot tube in balancing the air system. Extensions, complete with cap or plug, shall be provided where the ducts are insulated.

### **3.1.11 Power Roof Ventilator Mounting**

Foamed 1/2 inch thick, closed-cell, flexible elastomer insulation shall cover width of roof curb mounting flange. Where wood nailers are used, holes shall be pre-drilled for fasteners.

### **3.1.12 Power Transmission Components Adjustment**

V-belts and sheaves shall be tested for proper alignment and tension prior to operation and after 72 hours of operation at final speed. Belts on drive side shall be uniformly loaded, not bouncing. Alignment of direct driven couplings shall be to within 50 percent of manufacturer's maximum allowable range of misalignment.

## **3.2 FIELD PAINTING AND PIPING IDENTIFICATION**

Finish painting of items only primed at the factory or surfaces not specifically noted otherwise and identification for piping are specified in Section 09900 PAINTING, GENERAL.

## **3.3 DUCTWORK LEAK TEST**

Ductwork leak test shall be performed for the entire air distribution and exhaust system, including fans, coils, filters, etc. Test procedure, apparatus, and report shall conform to SMACNA-10. The maximum allowable leakage rate is 5%. Ductwork leak test shall be completed with satisfactory results prior to applying insulation to ductwork exterior.

## **3.4 CLEANING AND ADJUSTING**

Pipes shall be cleaned free of scale and thoroughly flushed of foreign matter.

A temporary bypass shall be provided for water coils to prevent flushing water from passing through coils. Strainers and valves shall be thoroughly cleaned. Prior to testing and balancing, air shall be removed from water systems by operating the air vents. Temporary measures, such as piping the overflow from vents to a collecting vessel shall be taken to avoid water damage during the venting process. Air vents shall be plugged or capped after the system has been vented. Inside of room fan-coil units ducts, plenums, and casing shall be thoroughly cleaned of debris and blown free of small particles of rubbish and dust and then shall be vacuum cleaned before installing outlet faces. Equipment shall be wiped clean, with traces of oil, dust, dirt, or paint spots removed. Temporary filters shall be provided prior to startup of all fans that are operated during construction, and new filters shall be installed after all construction dirt has been removed from the building, and the ducts, plenums, casings, and other items specified have been vacuum cleaned. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

## **3.5 TESTING, ADJUSTING, AND BALANCING**

Testing, adjusting, and balancing shall be as specified in Section 15990 TESTING, ADJUSTING AND BALANCING OF HVAC SYSTEMS. Testing, adjusting, and balancing shall begin only when the air supply and distribution, including controls, has been completed, with the exception of performance tests.

### **3.6 PERFORMANCE TESTS**

After testing, adjusting, and balancing has been completed as specified, each system shall be tested as a whole to see that all items perform as integral parts of the system and temperatures and conditions are evenly controlled throughout the building. Corrections and adjustments shall be made as necessary to produce the conditions indicated or specified. Capacity tests and general operating tests shall be conducted by an experienced engineer. Tests shall cover a period of not less than five (5) days for each system and shall demonstrate that the entire system is functioning according to the specifications. Coincidental chart recordings shall be made at points indicated on the drawings for the duration of the time period and shall record the temperature at space thermostats or space sensors, the humidity at space humidistats or space sensors and the ambient temperature and humidity in a shaded and weather protected area.

### **3.7 FIELD TRAINING**

The Contractor shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 24 hours of normal working time and shall start after the system is functionally complete but prior to the performance tests. The field instruction shall cover all of the items contained in the approved Operating and Maintenance Instructions.

--End of Section--



## SECTION 15951

### DIRECT DIGITAL CONTROL FOR HVAC

#### **PART 1 GENERAL**

##### **1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

##### AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI C12.1 (1988) Code for Electricity Metering
- ANSI X3.64 (1979; R 1990) Additional Controls for Use with American National Standard Code for Information Interchange
- ANSI X3.154 (1988) Office Machines and Supplies - Alphanumeric Machines-Keyboards Arrangement

##### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM A 269 (1994a) Seamless and Welded Austenitic Stainless Steel Tubing for General Service
- ASTM B 88 (1993a) Seamless Copper Water Tube
- ASTM D 635 (1991) Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
- ASTM D 1693 (1970; R 1988) Environmental Stress-Cracking of Ethylene Plastics

##### AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

- ASHRAE-03 (1993; Errata) Handbook, Fundamentals I-P Edition

##### AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

- ASME B40.1 (1991) Gauges - Pressure Indicating Dial Type - Elastic Element
- ASME PTC 19.3 (1974; R 1986) Instruments and Apparatus: Part 3 Temperature Measurement

##### CODE OF FEDERAL REGULATIONS (CFR)

- 47 CFR 68 Connection of Terminal Equipment to the Telephone Network

##### INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- IEEE C62.41 (1991) Surge Voltages in Low-Voltage AC Power Circuits
- IEEE Std 142 (1991) IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (1991) Enclosures for Electrical Equipment (1000 Volts Maximum)

NEMA ICS 1 (1993) Industrial Controls and Systems

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA-07 (1993) HVAC Systems - Testing, Adjusting and Balancing

UNDERWRITERS LABORATORIES (UL)

UL 94 (1991; Rev thru May 1994) Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

## **1.2 GENERAL REQUIREMENTS**

The direct digital control (DDC) shall be a complete system suitable for the control of all heating, ventilating and air-conditioning (HVAC) system. Except room fan coil units, room fan coil unit controls shall be low voltage electric type as shown on the RFP drawings.

### **1.2.1 Nameplates, Lens Caps, and Tags**

Nameplates and lens caps bearing legends as shown and tags bearing device-unique identifiers as shown shall have engraved or stamped characters. Nameplates shall be mechanically attached to Direct Digital Control (DDC) panel interior doors. A plastic or metal tag shall be mechanically attached directly to each device or attached by a metal chain or wire. Each airflow measurement station shall have a tag showing flow rate range for signal output range, duct size, and identifier as shown.

### **1.2.2 Verification of Dimensions**

The Contractor shall become familiar with all details of the work, shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

### **1.2.3 Drawings**

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor shall investigate the mechanical, electrical, and finish conditions that could affect the work to be performed, shall arrange such work accordingly, and shall furnish all work necessary to meet such conditions.

### **1.2.4 Power-Line Surge Protection**

Equipment connected to ac circuits shall be protected from power-line surges. Equipment protection shall meet the requirements of IEEE C62.41. Fuses shall not be used for surge protection.

### **1.2.5 Surge Protection for Transmitter and Control Wiring**

DDC system control-panel equipment shall be protected against surges induced on control and transmitter wiring installed outside and as shown. The equipment protection shall be tested in the normal mode and in the common mode, using the following two waveforms:

- a. A 10 microsecond by 1,000 microsecond waveform with a peak voltage of 1,500 volts and a peak current of 60 amperes.
- b. An 8 microsecond by 20 microsecond waveform with a peak voltage of 1,000 volts and a peak current of 500 amperes.

#### **1.2.6 Power-Line Conditioners (PLC)**

PLCs shall be furnished for each DDC panel. The PLCs shall provide both voltage regulation and noise rejection. The PLCs shall be of the ferro-resonant design, with no moving parts and no tap switching while electrically isolating the secondary from the power-line side. The PLCs shall be sized for 125 percent of the actual connected kVA load. Characteristics of the PLC shall be as follows:

- a. At 85 percent load, the output voltage shall not deviate by more than plus or minus 1 percent of nominal when the input voltage fluctuates between minus 20 percent to plus 10 percent of nominal.
- b. During load changes of zero to full load, the output voltage shall not deviate by more than plus or minus 3 percent of nominal. Full correction of load switching disturbances shall be accomplished within 5 cycles, and 95 percent correction shall be accomplished within two cycles of the onset of the disturbance.
- c. Total harmonic distortion shall not exceed 3-1/2 percent at full load.

#### **1.2.7 System Overall Reliability Requirement**

The system shall be configured and installed to yield a mean time between failure (MTBF) of at least 40,000 hours. Each DDC panel shall be designed, configured, installed and programmed to provide for stand alone operation with minimal performance degradation on failure of other system components to which it is connected or with which it communicates.

#### **1.2.8 Multiple DDC Panel Requirement**

Where the system to be controlled by the DDC system is located in multiple mechanical rooms, each mechanical room shall have at least one DDC panel. DDC panels shall not control equipment located in a different mechanical room. DDC panels shall be located in the same room as the equipment being controlled or in an adjacent space which has direct access to the equipment room.

#### **1.2.9 System Accuracy and Display**

The system shall maintain an end-to-end accuracy for 1 year from sensor to operator's console display for the applications specified and shall display the value as specified. Each temperature shall be displayed and printed to nearest 0.1 degree F.

##### **1.2.9.1 Space Temperature**

Space temperature with a range of 50 to 85 degrees F plus or minus 0.75 degree F for conditioned space; 30 to 130 degrees F plus or minus 1 degree F for unconditioned space.

##### **1.2.9.2 Duct Temperature**

Duct temperature with a range of 40 to 140 degrees F plus or minus 2 degrees F.

#### **1.2.9.3 Outside Air Temperature**

Outside air (OA) temperature with a range of minus 30 to plus 130 degrees F plus or minus 2 degrees F; with a subrange of 30 to 100 degrees F plus or minus 1 degree F.

#### **1.2.9.4 Water Temperature**

Water temperature with a range of 30 to 100 degrees F plus or minus 0.75 degree F; the range of 100 to 250 degrees F plus or minus 2 degrees F; and water temperatures for the purpose of performing Btu calculations using differential temperatures to plus or minus 0.5 degrees F using matched sensors.

#### **1.2.9.5 High Temperature**

High temperature with a range of 200 to 500 degrees F plus or minus 2.0 degrees F.

#### **1.2.9.6 Relative Humidity**

Relative humidity with a range of 20 to 80 percent plus or minus 6.0 percent of range (display and print to nearest 1.0 percent).

#### **1.2.9.7 Pressure**

Pressure with a range for the specific application plus or minus 2.0 percent of range (display and print to nearest psi).

#### **1.2.9.8 Flow**

Flow with a range for the specific application plus or minus 3.0 percent of range, and flows for the purpose of thermal calculations to plus or minus 2.0 percent of actual flow (display and print to nearest unit, such as gallons per minute).

#### **1.2.9.9 Analog Value Input**

An analog value input to the system's equipment via an AI with a maximum error of 0.50 percent of range, not including the sensor or transmitter error. This accuracy shall be maintained over the specified environmental conditions.

### **1.3 DELIVERY AND STORAGE**

Products shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, and other contaminants, within the storage-condition limits published by the equipment manufacturer. Dampers shall be stored so that seal integrity, blade alignment and frame alignment are maintained.

### **1.4 TESTING**

#### **1.4.1 Factory Test**

The Contractor shall assemble the factory test DDC system as specified and perform test to demonstrate that the performance of the system satisfies the requirements of this specification. Model numbers of equipment tested shall be identical to those to be delivered to the site. Original copies of all data produced, including results of each test procedure during factory testing shall be delivered to the Government at the conclusion of testing, prior to Government approval of the test. The test results documentation shall be

arranged so that all commands, responses, and data acquired are correlated in a manner which will allow for logical interpretation of the data. The factory test setup shall include the following:

- a. Command Entry Device with Keyboard.
- b. Printer.
- c. Disk Storage.
- d. DDC Panel.
- e. DDC Panel Test Set.
- f. DDC Panel Portable Tester.
- g. Communication links of each type and speed including Modems.
- h. Dial-up Modem.
- i. Software.

#### **1.4.2 Site Testing**

Personnel, equipment, instrumentation, and supplies shall be provided as necessary to perform site testing, adjusting, calibration and commissioning. The tests shall not be conducted during scheduled seasonal off periods of base heating and cooling systems. Wiring shall be tested for continuity and for ground, open, and short circuits. Tubing systems shall be tested for leaks. Ground rods installed by the Contractor shall be tested as specified in IEEE Std 142. Written Government approval of the specific site testing procedures shall be obtained prior to any test. Written notification of any planned site testing, commissioning or tuning shall be given at least 14 calendar days prior to any test.

#### **1.4.3 Control System Calibration, Adjustments, and Commissioning**

Instrumentation and controls shall be calibrated and the specified accuracy shall be verified using test equipment with calibration traceable to NIST standards. Mechanical control devices shall be adjusted to operate as specified. Control parameters and logic (virtual) points including control loop setpoints, gain constants, and integral constraints, shall be adjusted before the system is placed on line. Communications requirements shall be as indicated. Control system commissioning shall be performed for each HVAC system. The report describing results of functional tests, diagnostics, and calibrations, including written certification, shall state that the installed complete system has been calibrated, tested, and is ready to begin performance verification testing. The report shall also include a copy of the approved performance verification test procedure.

#### **1.4.4 Performance Verification Test**

Compliance of the HVAC control system with the contract documents shall be demonstrated. Using test plans and procedures previously approved, physical and functional requirements of the project, including communication requirements shall be demonstrated. The performance verification test procedures shall explain, step-by-step, the actions and expected results that will demonstrate that the control systems perform in accordance with the sequences of operation. The performance verification test shall not be started until after receipt of written permission by the Government, based on the Contractor's written certification of successful completion of site testing and training.

#### **1.4.5 Endurance Test**

The endurance test shall be used to demonstrate the specified overall system reliability requirement of the completed system. The endurance test shall not be started until the Government notifies the Contractor in writing that the performance verification test is satisfactorily completed. The Government may terminate the testing at any time when the system fails to perform as specified. Upon termination of testing by the Government or by the Contractor, the Contractor shall commence an assessment period as described for Phase II. Upon successful completion of the endurance test, the Contractor shall deliver test reports and other documentation as specified to the Government prior to acceptance of the system.

##### **a. Phase I (Testing)**

The test shall be conducted 24 hours per day, 7 days per week, for 15 consecutive calendar days, including holidays, and the system shall operate as specified. The Contractor shall make no repairs during this phase of testing unless authorized by the Government in writing.

##### **b. Phase II (Assessment)**

After the conclusion of Phase I, the Contractor shall identify failures, determine causes of failures, repair failures, and deliver a written report to the Government. The report shall explain in detail the nature of each failure, corrective action taken, results of tests performed, and shall recommend the point at which testing should be resumed. After delivering the written report, the Contractor shall convene a test review meeting at the jobsite to present the results and recommendations to the Government. As a part of this test review meeting, the Contractor shall demonstrate that all failures have been corrected by performing appropriate portions of the performance verification test. Based on the Contractor's report and test review meeting, the Government may require that the Phase I test be totally or partially rerun. After the conclusion of any retesting which the Government may require, the Phase II assessment shall be repeated as if Phase I had just been completed.

#### **1.4.6 Coordination with HVAC System Balancing**

The HVAC control system shall be tuned after all air-system and hydronic-system balancing has been completed, minimum damper positions set and a report issued. Commissioning may be performed prior to or simultaneous with HVAC system balancing.

#### **1.4.7 Posted Instructions**

Instructions on letter-size sheets and half-size plastic laminated drawings for each system, showing the final installed conditions, shall be placed in each HVAC control panel. The posted instructions shall include the control sequence, control schematic, ladder diagram, wiring diagram, valve schedules, damper schedules, commissioning procedures, and preventive maintenance instructions.

### **1.5 TRAINING**

#### **1.5.1 General**

The training course shall be conducted for three operating staff members designated by the Contracting Officer in the maintenance and operation of the system, including specified hardware and software. A training day is defined as 8 hours of classroom instruction, including breaks and lunchtime, Monday

through Friday, during the daytime shift in effect at the training facility. For guidance in planning the required instruction, the Contractor shall assume that the attendees will have a high school education or equivalent, and are familiar with HVAC systems. No training shall be scheduled until training manuals and O&M manuals have been approved by the Government.

### **1.5.2 Training Course Content**

The course shall be taught at the project site for a period of 4 training days. The training course shall cover all the material contained in the Operating and Maintenance Instructions, the layout and location of each HVAC control panel, the layout of one of each type of unitary equipment and the locations of each, the location of each system-control device external to the panels, the location of the compressed-air station, preventive maintenance, troubleshooting, diagnostics, calibration, adjustment, commissioning, tuning, and repair procedures. Typical systems and similar systems may be treated as a group, with instruction on the physical layout of one such system. The results of the performance verification test and the calibration, adjustment and commissioning report shall be presented as benchmarks of HVAC control-system performance by which to measure operation and maintenance effectiveness.

## **1.6 MAINTENANCE AND SERVICE**

### **1.6.1 General Requirements**

Services, materials and equipment shall be provided as necessary to maintain the entire system in an operational state as specified for a period of 1 year after successful completion and acceptance of the Performance Verification Test. Impacts on facility operations shall be minimized. Contractor's personnel shall be factory authorized to accomplish the required services.

### **1.6.2 Description of Work**

The adjustment and repair of the system shall include the manufacturer's required adjustments of computer equipment, software updates, transmission equipment and instrumentation and control devices.

### **1.6.3 Personnel**

Service personnel shall be qualified to accomplish work promptly and satisfactorily. The Government shall be advised in writing of the name of the designated service representative, and of any changes in personnel.

### **1.6.4 Scheduled Inspections**

Two inspections shall be performed at 6 month intervals (or less if required by the manufacturer), and all work required shall be performed. Inspections shall be scheduled in June and December. These inspections shall include:

- a. Visual checks and operational tests of all equipment.
- b. Fan checks and filter changes for all control system equipment.
- c. Clean all control system equipment including interior and exterior surfaces.
- d. Check and calibrate each field device. Check and calibrate 50 percent of the total analog points during the first inspection. Check and calibrate the remaining 50 percent of the analog points during the second major inspection. Certify analog test instrumentation accuracy to be twice that of the device being calibrated. Randomly check at

least 25 percent of all digital points for proper operation during the first inspection. Randomly check at least 25 percent of the remaining digital points during the second inspection.

e. Run all system software diagnostics and correct all diagnosed problems.

f. Resolve any previous outstanding problems.

#### **1.6.5 Scheduled Work**

This work shall be performed during regular working hours, Monday through Friday, excluding legal holidays.

#### **1.6.6 Emergency Service**

The Government will initiate service calls when the system is not functioning properly. Qualified personnel shall be available to provide service to the system. A telephone number where the service supervisor can be reached at all times shall be provided. Service personnel shall be at the site within 24 hours after receiving a request for service. The control system shall be restored to proper operating condition within 24 hours after receiving a request for service.

#### **1.6.7 Operation**

Scheduled adjustments and repairs shall include verification of the control system operation as demonstrated by the applicable tests of the performance verification test.

#### **1.6.8 Records and Logs**

Dated records and logs shall be kept of each task, with cumulative records for each major component, and for the complete system chronologically. A continuous log shall be maintained for all devices. The log shall contain all initial analog span and zero calibration values and all digital points. Complete logs shall be kept and shall be available for inspection onsite, demonstrating that planned and systematic adjustments and repairs have been accomplished for the control system.

#### **1.6.9 Work Requests**

Each service call request shall be recorded as received and shall include the serial number identifying the component involved, its location, date and time the call was received, nature of trouble, names of the service personnel assigned to the task, instructions describing what has to be done, the amount and nature of the materials to be used, the time and date work started, and the time and date of completion. A record of the work performed shall be submitted within 5 days after work is accomplished.

#### **1.6.10 System Modifications**

Recommendations for system modification shall be submitted in writing. System modifications, including operating parameters and control settings, shall not be made without prior approval of the Government. Any modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected.



### **1.6.11 Software**

Updates to the software shall be provided for system; operating and application software shall be updated and operation in the system shall be verified. Updates shall be incorporated into operations and maintenance manuals, and software documentation. There shall be at least one scheduled update near the end of the first year's warranty period, at which time the latest released version of the Contractor's software shall be installed and validated.

## **PART 2 PRODUCTS**

### **2.1 GENERAL EQUIPMENT REQUIREMENTS**

Units of the same type of equipment shall be products of a single manufacturer. Each major component of equipment shall have the manufacturer's name and address, and the model and serial number in a conspicuous place. Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of such products, which are of a similar material, design and workmanship. The standard products shall have been in a satisfactory commercial or industrial use for 2 years prior to use on this project. The 2 years use shall include applications of equipment and materials under similar circumstances and of similar size. The 2 years experience shall be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2 year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6,000 hours exclusive of the manufacturer's factory tests, can be shown. The equipment items shall be supported by a service organization. Items of the same type and purpose shall be identical, including equipment, assemblies, parts and components. Automatic temperature controls shall be direct digital controls that will provide the required sequence of operation. No pneumatics will be allowed except for valve or damper actuators.

#### **2.1.1 Electrical and Electronic Devices**

Electrical, electronic, and electropneumatic devices not located within an HVAC control panel shall have a NEMA ICS 1 enclosure in accordance with NEMA 250 unless otherwise shown.

#### **2.1.2 Standard Signals**

Except for air distribution terminal unit control equipment, the output of all analog transmitters and the analog input and output of all DDC panels shall be 4-to-20 mA<sub>dc</sub> signals. The signal shall originate from current-sourcing devices and shall be received by current-sinking devices.

#### **2.1.3 Ambient Temperature Limits**

DDC panels shall have ambient condition ratings of plus 35 to 120 degrees F and 10 to 95 percent relative humidity, noncondensing. Devices installed outdoors shall operate within limit ratings of minus 35 to 150 degrees F. Instrumentation and control elements shall be rated for continuous operation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified or normally encountered for the installed location.

## **2.2 TUBING**

### **2.2.1 Copper**

Copper tubing shall conform to ASTM B 88 and shall have sweat fittings and valves.

### **2.2.2 Stainless Steel**

Stainless steel tubing shall conform to ASTM A 269 and shall have stainless steel compression fittings.

### **2.2.3 Plastic**

Plastic tubing shall have barbed fittings and valves. Plastic tubing shall have the burning characteristics of linear low-density polyethylene tubing, shall be self-extinguishing when tested in accordance with ASTM D 635, shall have UL 94 V-2 flammability classification, and shall withstand stress cracking when tested in accordance with ASTM D 1693. Plastic-tubing bundles shall be provided with Mylar barrier and flame-retardant polyethylene jacket.

## **2.3 WIRING**

### **2.3.1 Terminal Blocks**

Terminal blocks shall be insulated, modular, feed-through, clamp style with recessed captive screw-type clamping mechanism, shall be suitable for rail mounting, and shall have end plates and partition plates for separation or shall have enclosed sides.

### **2.3.2 Control Wiring for 24-Volt Circuits**

Control wiring for 24-volt circuits shall be 18 AWG minimum and shall be rated for 300-volt service.

### **2.3.3 Wiring for 120-Volt Circuits**

Wiring for 120-volt circuits shall be 14 AWG minimum and shall be rated for 600-volt service.

### **2.3.4 Instrumentation Cable**

Instrumentation cable shall be 18 AWG, stranded copper, single- or multiple-twisted, minimum 2 inch lay of twist, 100 percent shielded pairs, and shall have a 300-volt insulation. Each pair shall have a 20 AWG tinned-copper drain wire and individual overall pair insulation. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape, overall 20 AWG tinned-copper cable drain wire, and overall cable insulation.

## **2.4 ACTUATORS**

### **2.4.1 General Requirements**

Actuators shall be pneumatic, electric or electronic. Actuators shall fail to their spring-return positions on signal or power failure and shall have a visible position indicator. Actuators shall open or close the devices to which they are applied within 60 seconds after a full scale input signal change. Electric or electronic actuators operating in parallel or in sequence shall have an auxiliary actuator driver.

#### **2.4.2 Damper Actuators**

The actuators shall be provided with mounting and connecting hardware. Actuators shall smoothly operate the devices to which they are applied. Actuators shall fully open and close the devices to which they are applied and shall have a full stroke response time of 60 seconds or less. The actuator stroke shall be limited by an adjustable stop in the direction of power stroke.

#### **2.4.3 Valve Actuators**

Valve actuators shall be selected to provide a minimum of 125 percent of the motive power necessary to operate the valve over its full range of operation.

### **2.5 AUTOMATIC CONTROL VALVES**

Valves shall have stainless-steel stems and stuffing boxes with extended necks to clear the piping insulation. Valve bodies shall be designed for not less than 125 psig working pressure or 150 percent of the system operating pressure, whichever is greater. Valve leakage rating shall be 0.01 percent of rated Cv. Unless otherwise specified, bodies for valves 1-1/2 inches and smaller shall be brass or bronze, with threaded or union ends; bodies for 2 inch valves shall have threaded ends; and bodies for valves 2 to 3 inches shall be of brass, bronze or iron. Bodies for valves 2-1/2 inches and larger shall be provided with flanged-end connections. Valve Cv shall be within 100 to 125 percent of the Cv shown.

#### **2.5.1 Butterfly-Valve Assembly**

Butterfly valves shall be threaded lug type suitable for dead-end service and modulation to the fully-closed position, with carbon-steel bodies and noncorrosive discs, stainless steel shafts supported by bearings, and EPDM seats suitable for temperatures from 20 to 250 degrees F. Valves shall have a manual means of operation independent of the actuator.

#### **2.5.2 Two-Way Valves**

Two-way modulating valves shall have equal-percentage characteristics.

#### **2.5.3 Three-Way Valves**

Three-way valves shall provide linear flow control with constant total flow throughout full plug travel.

#### **2.5.4 Duct Coil and Terminal-Unit Coil Valves**

Control valves with either flare-type or solder-type ends shall be provided for duct or terminal-unit coils. Flare nuts shall be furnished for each flare-type end valve.

#### **2.5.5 Valves for Chilled Water Service**

Internal valve trim shall be bronze except that valve stems may be type 316 stainless steel. Valve Cv shall be within 100 to 125 percent of the Cv shown. Valves 4 inches and larger shall be butterfly.

#### **2.5.6 Valves for Hot Water and Dual Temperature Service**

For hot water service below 250 degrees F and Dual Temperature Service, internal trim (including seats, seat rings, modulating plugs, and springs) of valves controlling water hotter than 210 degrees F shall be Type 316 stainless

steel. Internal trim for valves controlling water 210 degrees F or less shall be brass or bronze. Nonmetallic parts of hot-water control valves shall be suitable for a minimum continuous operating temperature shall be suitable for a minimum continuous operating temperature of 250 degrees F or 50 degrees F above the system design temperature, whichever is higher. Valves 4 inches and larger shall be butterfly valves.

## **2.6 DAMPERS**

### **2.6.1 Damper Assembly**

A single damper section shall have blades no longer than 48 inches and shall be no higher than 72 inches. Maximum damper blade width shall be 8 inches. Larger sizes shall be made from a combination of sections. Dampers shall be steel, or other materials where shown. Flat blades shall be made rigid by folding the edges. Blade-operating linkages shall be within the frame so that blade-connecting devices within the same damper section shall not be located directly in the air stream. Damper axles shall be 0.5 inch minimum, plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by thrust bearings. Pressure drop through dampers shall not exceed 0.04 inch water gauge at 1,000 feet per minute in the wide-open position. Frames shall not be less than 2 inches in width. Dampers shall be tested in accordance with AMCA 500.

### **2.6.2 Operating Links**

Operating links external to dampers, such as crankarms, connecting rods, and line shafting for transmitting motion from damper actuators to dampers, shall withstand a load equal to at least twice the maximum required damper-operating force. Rod lengths shall be adjustable. Links shall be brass, bronze, zinc-coated steel, or stainless steel. Working parts of joints and clevises shall be brass, bronze, or stainless steel. Adjustments of crankarms shall control the open and closed positions of dampers.

### **2.6.3 Damper Types**

Dampers shall be parallel blade type.

#### **2.6.3.1 Outside Air Dampers**

Outside air dampers shall be provided. Blades shall have interlocking edges and shall be provided with compressible seals at points of contact. The channel frames of the dampers shall be provided with jamb seals to minimize air leakage. Dampers shall not leak in excess of 20 cfm per square foot at 4 inches water gauge static pressure when closed. Seals shall be suitable for an operating temperature range of minus 40 degrees F to 200 degrees F. Dampers shall be rated at not less than 2,000 feet per minute air velocity.

#### **2.6.3.2 Mechanical and Electrical Space Ventilation Dampers**

Mechanical and electrical space ventilation dampers shall not leak in excess of 80 cfm per square foot at 4 inches water gauge static pressure when closed. Dampers shall be rated at not less than 1,500 feet per minute air velocity.

## **2.7 SMOKE DETECTORS**

Smoke detectors shall be as specified in Section 16721 FIRE DETECTION AND ALARM SYSTEM.

## **2.8 INSTRUMENTATION**

### **2.8.1 Measurements**

Each transmitter shall have offset and span adjustments. Transmitters shall be calibrated to provide the following measurements, over the indicated ranges, for a linear output of 4-to-20 mAdc:

- a. Conditioned space temperature, from 50 to 85 degrees F.
- b. Duct temperature, from 40 to 140 degrees F except that return air temperature for economizer operation shall be minus 30 to plus 130 degrees F.
- c. High temperature hot water, from 200 to 500 degrees F.
- d. Chilled water temperature, from 30 to 100 degrees F.
- e. Dual temperature water, from 30 to 240 degrees F.
- f. Heating hot water temperature, from 100 to 250 degrees F.
- g. Outside air temperature, from minus 30 to plus 130 degrees F.
- h. Relative humidity, 0 to 100 percent for high limit applications; from 20 to 80 percent for space applications.
- i. Pitot tube air flow measurement station and transmitter, from 0 to 0.1 inch water gauge for flow velocities of 500 to 1,200 fpm; 0 to 0.25 inch water gauge for velocities of 500 to 1,800 fpm; or 0 to 0.5 inch water gauge for velocities of 500 to 2,500 fpm.
- j. Electronic air flow measurement station and transmitter, from 125 to 2,500 fpm.

### **2.8.2 Temperature Instruments**

#### **2.8.2.1 Resistance Temperature Detectors (RTD)**

Each RTD shall be platinum with a tolerance of plus or minus 0.1 percent at 32 degrees F, and shall be encapsulated in epoxy, series 300 stainless steel, anodized aluminum, or copper. Each RTD shall be furnished with an RTD transmitter as specified, integrally mounted unless otherwise shown.

#### **2.8.2.2 Continuous Averaging RTD**

Continuous averaging RTDs shall have a tolerance of plus or minus 1.0 degree F at the reference temperature, and shall be of sufficient length to ensure that the resistance represents an average over the cross section in which it is installed. The sensing element shall have a bendable copper sheath. Each averaging RTD shall be furnished with an RTD transmitter to match the resistance range of the averaging RTD.

#### **2.8.2.3 RTD Transmitter**

The RTD transmitter shall match the resistance range of the RTD. The transmitter shall be a 2-wire, loop powered device. The transmitter shall produce a linear 4-to-20 mAdc output corresponding to the required temperature measurement. The output error shall not exceed 0.1 percent of the calibrated measurement.

### **2.8.3 Relative Humidity Instruments**

Relative humidity sensing element shall have a relative humidity sensing range from 0-100 percent (condensing). The sensor shall be capable of, sensing a condensing air stream (100 percent RH) without affect to the sensors calibration or harm to the sensor. The sensor shall be wall mount type or duct mount type as appropriate and shall be provided with the required accessories. Duct sensors shall be provided with duct probe designed to protect the sensing element from dust accumulation and mechanical damage. Sensing elements shall have an accuracy of plus or minus 5 percent of full scale within the range of 20 to 80 percent relative humidity. A 2-wire, loop powered transmitter located at the sensing element shall be provided to convert the sensing element output to a linear 4-to-20 mA<sub>dc</sub> output corresponding to the required humidity measurement. The output error shall not exceed 0.1 percent of calibrated measurement.

### **2.8.4 Electronic Airflow Measurement Stations and Transmitters**

#### **2.8.4.1 Stations**

Each station shall contain an array of velocity sensing elements and straightening vanes inside a flanged sheet metal casing. The velocity sensing elements shall be of the RTD or thermistor type, with linearizing means. The sensing elements shall be distributed across the duct cross section in the quantity and pattern set forth for measurements and instruments of ASHRAE-03 and SMACNA-07 for the traversing of ducted air flows. The resistance to air flow through the airflow measurement station shall not exceed 0.08 inch water gauge at an airflow of 2,000 fpm. Station construction shall be suitable for operation at airflows of up to 5,000 fpm over a temperature range of 40 to 120 degrees F, and accuracy shall be plus or minus 3 percent over a range of 125 to 2,500 fpm scaled to air volume.

#### **2.8.4.2 Transmitters**

Each transmitter shall produce a linear, temperature compensated 4-to-20 mA<sub>dc</sub>, output corresponding to the required velocity pressure measurement. The transmitter shall be a 2-wire, loop powered device. The output error of the transmitter shall not exceed 0.5 percent of the calibrated measurement.

### **2.8.5 Pitot Tube Airflow Measurement Stations and Transmitters**

#### **2.8.5.1 Stations**

Each station shall contain an array of velocity sensing elements and straightening vanes inside a flanged sheet metal casing. The velocity sensing elements shall be of the multiple pitot tube type with averaging manifolds. The sensing elements shall be distributed across the duct cross section in the quantity and pattern set forth for measurements and instruments of ASHRAE-03 or SMACNA-07 for the traversing of ducted airflows. The resistance to airflow through the airflow measurement station shall not exceed 0.08 inch water gauge at an airflow of 2,000 fpm. Station construction shall be suitable for operation at airflows of up to 5,000 fpm over a temperature range of 40 to 120 degrees F, and accuracy shall be plus or minus 3 percent over a range of 500 to 2,500 fpm scaled to air volume. This device shall not be used if the required velocity measurement is below 700 fpm.

#### **2.8.5.2 Transmitters**

Each transmitter shall produce a linear 4-to-20 mA<sub>dc</sub> output corresponding to the required velocity pressure measurement. Each transmitter shall have a low range differential pressure sensing element. The transmitter shall be a 2-wire, loop powered device. Sensing element accuracy shall be plus or minus

1 percent of full scale, and overall transmitter accuracy shall be plus or minus 0.25 percent of the calibrated measurement.

#### **2.8.6 Differential Pressure Instruments**

The instrument shall be a pressure transmitter with an integral sensing element. The instrument over pressure rating shall be 300 percent of the operating pressure. The sensor/transmitter assembly accuracy shall be plus or minus 2 percent of full scale. The transmitter shall be a 2-wire, loop powered device. The transmitter shall produce a linear 4-to-20 mA<sub>dc</sub> output corresponding to the required pressure measurement.

#### **2.8.7 Thermowells**

Thermowells shall be Series 300 stainless steel with threaded brass plug and chain, 2 inch lagging neck and extension type well. Inside diameter and insertion length shall be as required for the application.

#### **2.8.8 Sunshields**

Sunshields for outside air temperature sensing elements shall prevent the sun from directly striking the temperature sensing elements. The sunshields shall be provided with adequate ventilation so that the sensing element responds to the ambient temperature of the surroundings. The top of each sunshield shall have a galvanized metal rainshield projecting over the face of the sunshield. The sunshields shall be painted white.

### **2.9 THERMOSTATS**

#### **2.9.1 General**

Thermostat ranges shall be selected so that the setpoint is adjustable between plus or minus 10 degrees F of the setpoint shown. Thermostats shall be electric or low-voltage electronic.

#### **2.9.2 Nonmodulating Room Thermostats**

Contacts shall be single-pole double-throw (SPDT), hermetically sealed, and wired to identified terminals. Maximum differential shall be 5 degrees F. Room thermostats shall be enclosed with separate locking covers (guards).

#### **2.9.3 Microprocessor Based Room Thermostats**

Microprocessor based thermostats shall have built-in keypads for scheduling of day and night temperature settings. Access to the scheduling mode shall be by a password control code. When out of the scheduling mode, thermostats shall have continuous display of time, with AM and PM indicator, continuous display of day of week, and either continuous display of room temperature with display of temperature setpoint on demand, or continuous display of temperature setpoint with display of room temperature on demand. In the programmable mode, the display shall be used for setting and interrogating time program ON-OFF setpoints for all 7 days of the week. The time program shall allow two separate temperature setback intervals per day. The thermostats shall have a means for temporary and manual override of the program schedule, with automatic program restoration on the following day. Thermostats shall have a replaceable battery to maintain the timing and maintain the schedule in memory for 1 year in the event of a power outage. Maximum differential shall be 2 degrees F. When used for heat pump applications, the thermostat shall have an emergency heat switch.

#### **2.9.4 Modulating Room Thermostats**

Modulating room thermostats shall have either one output signal, two output signals operating in unison, or two output signals operating in sequence, as required for the application. Each thermostat shall have an adjustable throttling range of 4 to 8 degrees F for each output. Room thermostats shall be enclosed with separate locking covers (guards).

#### **2.9.5 Nonmodulating Capillary Thermostats and Aquastats**

Each thermostat shall have a capillary length of at least 5 feet, shall have adjustable direct reading scales for both setpoint and differential, and shall have a differential adjustable from 6 to 16 degrees F. Aquastats shall be of the strap-on type, with 10 degrees F fixed differential.

#### **2.9.6 Freezestats**

Freezestats shall be manual reset, low temperature safety thermostats, with NO and NC contacts and a 20 foot element which shall respond to the coldest 18 inch segment.

#### **2.9.7 Modulating Capillary Thermostats**

Each thermostat shall have either one output signal, two output signals operating in unison, or two output signals operating in sequence, as required for the application. Thermostats shall have adjustable throttling ranges of 4 to 8 degrees F for each output.

#### **2.9.8 Fan Coil Unit Room Thermostats**

Fan coil unit room thermostats in personnel living spaces shall be of the low voltage type with locking covers, and shall be wall mounted not less than 60 inches above the floor, unless otherwise shown. Electrical rating shall not exceed 2.5 amperes at 30 volts ac. Housing shall be corrosion resisting metal or molded plastic. Transformer and fan relay shall be provided for the proper operation of each thermostatic control system as necessary to suit the design of the control system using the thermostats specified below. Either separate heating thermostats and separate cooling thermostats or dual element heating cooling thermostats may be provided as shown on drawings. Motor speed switches shall be provided for 3-speed fan control.

##### **2.9.8.1 Combination Thermostat**

Fan coil unit combination heating-cooling thermostats shall be provided with separate temperature sensing elements for each system, and shall have a single-pole, single-throw switch, hermetically sealed and actuated by a bimetallic or bellows type element. Each element shall operate switches to provide single stage control for heating and cooling. Heating and cooling circuits shall be electrically isolated from each other. Scales and ranges shall be as specified for individual thermostats. Thermostats shall contain, or a subbase shall be provided which contains, selector switches for Heat-Off-Cool. A changeover controller providing automatic summer-winter changeover for thermostats by sensing the supplied fluid temperature shall be provided. A limited range heating-cooling dead band thermostat shall control cooling when temperature is below the lower set point and shall have a dead band, with no heating or cooling, when temperature is between the set points. Set point adjustments shall be concealed.



## **2.10 PRESSURE SWITCHES AND SOLENOID VALVES**

### **2.10.1 Pressure Switches**

Each switch shall have an adjustable setpoint with visible setpoint scale. Range shall be as shown. Differential adjustment shall span 20 to 40 percent of the range of the device.

### **2.10.2 Differential Pressure Switches**

Each switch shall be an adjustable diaphragm-operated device with two SPDT contacts, with taps for sensing lines to be connected to duct pressure fittings designed to sense air pressure. These fittings shall be of the angled-tip type with tips pointing into the air stream. Range shall be 5.0 to 6.0 inches water gauge. Differential shall be a maximum of 0.15 inch water gauge at the low end of the range and 0.35 inch water gauge at the high end of the range.

## **2.11 INDICATING DEVICES**

### **2.11.1 Insertion Thermometers**

Thermometers for insertion in ductwork and piping systems shall have brass, malleable iron, or aluminum alloy case and frame, clear protective face, permanently stabilized glass tube with indicating-fluid column, white face, black numbers, and a 9 inch scale. Thermometers for piping systems shall have rigid stems with straight, angular, or inclined pattern, and shall conform to ASME PTC 19.3.

### **2.11.2 Thermometer Stems**

Thermometer stems shall have expansion heads as required to prevent breakage at extreme temperatures. On rigid-stem thermometers, the space between bulb and stem shall be filled with a heat-transfer medium.

### **2.11.3 Air Duct Thermometers**

Air duct thermometers shall have perforated stem guards and 45 degree adjustable duct flanges with locking mechanism.

### **2.11.4 Averaging Thermometers**

Averaging thermometers shall have 3-1/2 inch (nominal) dial, with black legend on white background, and pointer traveling through a 270 degree arc.

### **2.11.5 Accuracy**

Thermometers shall have an accuracy of plus or minus 1 percent of scale range. Thermometers shall have the following ranges:

- a. Mixed air, return air, cooling-coil discharge, chilled water, condenser water, and glycol cooling temperatures: 0 to 100 degrees F in 1 degree graduations.
- b. Heating-coil discharge temperature: 30 to 180 degrees F in 2 degree graduations.
- c. Hydronic heating systems below 220 degrees F: 40 to 240 degrees F in 2 degree graduations.

#### **2.11.6 Pressure Gauges**

Gauges shall be 2 inch (nominal) size, back connected, suitable for field or panel mounting as required, shall have black legend on white background, and shall have a pointer traveling through a 270 degree arc. Accuracy shall be plus or minus 3 percent of scale range. Gauges shall meet requirements of ASME B40.1.

##### **2.11.6.1 Hydronic System Gauges**

Gauges for hydronic system applications shall have ranges and graduations as shown.

##### **2.11.6.2 Low-Differential Pressure Gauges**

Gauges for low-differential pressure measurements shall be a minimum of 3.5 inch (nominal) size with two sets of pressure taps, and shall have a diaphragm-actuated pointer, white dial with black figures, and pointer zero adjustment. Gauges shall have ranges and graduations as shown. Accuracy shall be plus or minus 2 percent of scale range.

#### **2.12 RELAYS**

Control relay contacts shall have utilization category and ratings selected for the application, with a minimum of two sets of contacts (two normally open, two normally closed) enclosed in a dustproof enclosure. Relays shall be rated for a minimum life of one million operations. Operating time shall be 20 milliseconds or less. Relays shall be equipped with coil transient suppression devices to limit transients to 150 percent of rated coil voltage. Time delay relays shall be 2 PDT with 8-pin connectors, dust cover, and a matching rail mounted socket. Adjustable timing range shall be 0 to 3 minutes. Power consumption shall not be greater than 3 watts.

#### **2.13 WATTHOUR METERS**

Watthour meters shall be in accordance with ANSI C12.1 and shall have pulse initiators for remote monitoring of watthour consumption. Pulse initiators shall consist of contacts (one normally open, one normally closed) with a current rating not to exceed 2 amperes and voltage not to exceed 500 V, with combinations of VA not to exceed 100 VA, and a life rating of one billion operations. Pulse initiator contacts shall be connected to a terminal strip external to the meter enclosure. Meter sockets shall be in accordance with ANSI C12.1.

#### **2.14 WATTHOUR TRANSDUCERS**

Watthour transducers shall have an accuracy of plus or minus 0.25 percent of full scale for kW and kWh outputs from full lag to full lead power factor. Input ranges for kW and kWh transducers shall be selectable without requiring the changing of current or potential transformers. The output shall be 4-to-20 mA<sub>dc</sub>.

#### **2.15 FIELD HARDWARE**

##### **2.15.1 Direct Digital Control (DDC) Panel Hardware**

DDC panels shall be microcomputer based with sufficient memory to perform specified DDC panel functions and operations. The panel shall not be dependent on logic or data from an external computer. The panel shall contain necessary I/O functions to connect to field sensors and control devices. The DDC panel shall include:

- a. Main power switch.
- b. Power on indicator.
- c. Portable tester connector.
- d. On-Off-Auto switches for each digital output. The status of these switches will be available to the DDC panel for further processing.
- e. Minimum-Maximum-Auto switches, or Auto-Manual switches with manual potentiometer, for each analog output. The status of these switches will be available to the DDC panel for further processing.

#### **2.15.1.1 Sealed Battery Backup**

A sealed battery backup for the DDC panel memory and real time clock function sufficient to maintain them for a minimum period of 8 hours shall be provided. Automatic charging of batteries shall be provided, or alternately, lithium batteries sized to provide a minimum of 30 days operation and a shelf life of 2 years shall be provided. A low battery alarm with indication for each DDC panel shall be provided. Alternatively, capacitors may be provided to maintain memory and clock function for a minimum of 8 hours.

#### **2.15.1.2 Electrical Service Outlet for use with Test Equipment**

A single phase, 120 Vac electrical service outlet for use with test equipment shall be furnished either inside or within 6 feet of the DDC panel enclosure.

#### **2.15.1.3 Locking Type Mounting Cabinets**

Locking type mounting cabinets, with common keying and door switch wired to and DDC panel input for intrusion alarm annunciation, shall be furnished.

#### **2.15.1.4 Failure Mode**

Upon failure of the DDC panel, all connected points shall be forced to the failure mode shown in the I/O summary tables.

#### **2.15.1.5 Portable Tester**

Provisions for connection of a portable tester shall be furnished at each DDC panel location.

#### **2.15.1.6 I/O Functions**

I/O functions shall be provided as part of the DDC panel and shall be in accordance with the following:

- a. The Analog Input (AI) function shall monitor each analog input, perform A-to-D conversion, and hold the digital value in a buffer for interrogation. The A-to-D conversion shall have a minimum resolution of 10 bits plus sign. Signal conditioning shall be provided for each analog input. Analog inputs shall be individually calibrated for zero and span, in hardware or in software. The AI shall incorporate common mode noise rejection of 50 dB from 0 to 100 Hz for differential inputs, and normal mode noise rejection of 20 dB at 60 Hz from a source impedance of 10,000 ohms. Input ranges shall be within the range of 4-to-20 mAdc.

b. The Analog Output (AO) function shall accept digital data, perform D-to-A conversion, and output a signal within the range of 4-to-20 mA<sub>dc</sub>. D-to-A conversion shall have a minimum resolution of 8 bits plus sign. Analog outputs shall be individually calibrated for zero and span. Short circuit protection on voltage outputs and open circuit protection on current outputs shall be provided. An individual gradual switch for manual override of each analog output and means of physically securing access to these switches shall be provided. Each AO shall have a three-position switch for selection of the DDC control signal, no control, or a locally generated control signal for connection to the controlled device. Feedback shall be provided to the system as to the status of the output (manual control or automatic). Switches for pneumatic control outputs shall provide a connection for an externally generated pneumatic signal. All switches shall be either of a key operated design with the same keying system used for other outputs or otherwise suitably protected from unauthorized access.

c. The Digital Input (DI) function shall accept on-off, open-close, or other change of state (two state data) indications. Isolation and protection against an applied steady-state voltage up to 180 Vac peak shall be provided.

d. The Digital Output (DO) function shall provide contact closures for momentary and maintained operation of output devices. Closures shall have a minimum duration of 0.1 second. DO relays shall have an initial breakdown voltage between contacts and coil of at least 500 V peak. Electromagnetic interference suppression shall be furnished on all output lines to limit transients to nondamaging levels. Protection against an applied steady-state voltage up to 180 Vac peak shall be provided. Minimum contact rating shall be 1 ampere at 24 Vac. Key locked HOA switches shall be provided for manual override of each digital output. Feedback shall be provided to the system as to the status of the output (manual control or automatic). All switches shall be common keyed.

e. The pulse accumulator function shall have the same characteristics as the DI. In addition, a buffer shall be provided to totalize pulses and allow for interrogation by the DDC panel. The pulse accumulator shall accept rates up to 20 pulses per second. The totalized value shall be reset to zero upon operator's command.

f. Signal conditioning for sensors shall be provided as specified.

#### **2.15.2 Command Entry Device**

A command entry device shall be provided for use with DDC panels. The command entry device shall include a keyboard and display for local programming and setup. A printer and disk system shall also be provided. The command entry device shall be provided with communications interfaces to each DDC panel, and shall:

- a. Allow for entry of database information, including parameters and constraints from the keyboard.
- b. Display any digital, analog, and pulse accumulator input.
- c. Control any digital and analog output.
- d. Provide operator interface in alphanumeric and decimal.
- e. Disable/enable any DDC panel.

#### **2.15.2.1 Communications**

A port and proper cabling shall be provided to allow for communications between the command entry device and the DDC panel.

#### **2.15.2.2 Keyboard**

A keyboard shall be furnished with the command entry device panel. The keyboard shall include a 64-character standard ASCII character set based on ANSI X3.64 and ANSI X3.154. The keyboard shall also include a 10-key numeric keypad and 10 programmable function keys, light pen, or mouse. The keyboard shall provide a means for the operator to interact with all command and applications software.

#### **2.15.2.3 Printer**

A printer shall be provided for use with the command entry device panel. The printer shall have a minimum 96 character standard ASCII character set. It shall have adjustable sprockets for paper width up to 9.5 inches and a friction feed for paper width up to 8.5 inches, and shall print at least 80 columns per line. The printer shall have a minimum speed of 150 characters per second in utility mode (draft quality) and 32 characters per second in near-letter quality mode. Print mode shall be switch or software selectable. The minimum character spacing shall be 10 characters per inch and 3 to 8 lines per inch. The printer shall utilize standard form size, sprocket-fed fanfold paper. The unit shall have programmable control of top-of-form and variable line skip capability.

#### **2.15.2.4 Hard Disk**

The command entry device shall include a hard disk system having a maximum average access time no greater than 19 milliseconds, and a minimum of 1000 megabytes of formatted storage. The device shall allow each DDC panel database to be stored as a separate file suitable for transfer to floppy disk.

#### **2.15.2.5 Floppy Disk and CD Drives**

The command entry device shall include a 3.5 inch high density floppy disk system as part of the command entry device providing a minimum of 1.2 megabytes of formatted storage.

#### **2.15.3 DDC Panel Portable Tester**

Either as part of the command entry device or as a separate portable device capable of connection to any DDC panel, a portable test device shall be provided which includes a keyboard, display, and mass storage sufficient to perform, as a minimum, the following functions through the portable tester:

- a. Load all DDC panel software and information, including parameters and constraints.
- b. Display the status or value of all points connected to the DDC panel.
- c. Control the outputs connected to the DDC panel.
- d. Perform DDC panel diagnostic testing.
- e. Provide operator interface in alphanumerics and decimal (hexadecimal, octal, and binary display shall not be utilized).

- f. Accept DDC panel software and information from the command entry device panel for subsequent loading into a specific DDC panel. Provide all necessary software and hardware required to support this function.

#### **2.15.4 DDC Panel Test Set**

A DDC panel test set, consisting of a DDC panel and I/O simulator, shall be provided for use, located as shown, connected via a separate data transmission media (DTM) circuit. The I/O simulator shall manually generate the values or status for all I/O functions specified. The I/O simulator shall receive, display, and send different types of signals. Cables, connectors, test jacks, controls, indicators, and equipment required to simulate the I/O sensors and control devices and display the operation of all types of DDC panels used by the system shall be included. Indicators and controls shall be installed in a control panel. Test jacks for input and output signal of the I/O simulator shall be front panel mounted for use in diagnostics and evaluation. The I/O functions mix, including indicators and controls, shall be at least:

- a. 4 AI.
- b. 4 AO.
- c. 16 DI.
- d. 16 DO.
- e. 2 pulse accumulator inputs.
- f. One each of any other type utilized in the system.

#### **2.15.5 Communication Equipment**

The DDC panel shall be equipped with hardware to allow for communication over Data Transmission Media (DTM) using the communication network.

#### **2.15.6 Dial Up Modem**

A type V.32 Modem operating at 9600 BPS with automatic/selectable fall back operation with automatic answer and automatic dial capability shall be connected to the control system and to the telephone system and shall be certified to meet the requirements of 47 CFR 68.

### **2.16 DIRECT DIGITAL CONTROL PANEL SOFTWARE**

Each DDC panel, shall contain an operating system that controls and schedules that DDC panel's activities in real time. The DDC panel shall maintain a point database in its RAM that includes all parameters, constraints, and the latest value or status of all points connected to that DDC panel. The operating system shall include a real time clock function that maintains the seconds, minutes, hours, date and month, including day of the week. The operating system shall allow local loading of software and data files from the portable tester and from an operator interface panel.

#### **2.16.1 Command Priorities**

A scheme of priority levels shall be provided to prevent interaction of a command of low priority with a command of higher priority. The system shall require the latest highest priority command addressed to a single point to be stored for a period of time longer than the longest time constraint in the on and off states, ensuring that the correct command will be issued when the time

constraint is no longer in effect or report the rejected command. Override command entered by the operator shall have higher priority than those emanating from application programs.

#### **2.16.2 DDC Panel Startup**

The DDC panel shall have startup software that causes automatic commencement of operation without human intervention, including startup of all connected I/O functions. A DDC panel restart program based on detection of power failure at the DDC panel shall be included in the DDC panel software. Upon restoration of power to the DDC panel, the program shall restart all equipment and restore all loads to the state at time of power failure, or to the state as commanded by time programs or other overriding programs. The restart program shall include start time delays between successive commands to prevent demand surges or overload trips. The startup software shall initiate operation of self-test diagnostic routines. Upon failure of the DDC panel and if the database and application software are no longer resident, or if the clock cannot be read, the DDC panel shall not restart and systems shall remain in the failure mode until the necessary repairs are made. If the database and application programs are resident, the DDC panel shall resume operation after an adjustable time delay of from 0 to 600 seconds. The startup sequence for each DDC panel shall include a unique time delay setting when system operation is initiated.

#### **2.16.3 DDC Panel Operating Mode**

Each DDC panel shall control and monitor all functions independent of communication with any other source. The software shall perform DDC panel functions and DDC panel resident application programs using data obtained from I/O functions and based upon the DDC panel real time clock function. The DDC panel software shall execute commands after performing constraint checks in the DDC panel.

#### **2.16.4 DDC Panel Failure Mode**

Upon failure for any reason, the system shall perform an orderly shutdown and force all DDC panel outputs to a predetermined state, consistent with the failure modes defined in the I/O summary tables and the associated controlled devices.

#### **2.16.5 DDC Panel Functions**

Software necessary to accomplish the following functions, as appropriate, fully implemented and operational, within the DDC panel shall be provided:

- a. Scanning of inputs.
- b. Control of outputs.
- c. Store alarms for reporting when requested.
- d. Maintain real time.
- e. Execute DDC panel resident application programs.
- f. Averaging or filtering of each analog input.
- g. Constraint checks, prior to command issuance.
- h. DDC panel diagnostics.
- i. DDC panel portable tester operation.

#### **2.16.6 Analog Monitoring**

The DDC panel shall measure analog values and shall be capable of transmitting analog values for display. An analog change in value is defined as a change exceeding a preset differential value as specified. Displays and reports shall express analog values in proper engineering units with polarity sign. The system shall accommodate up to 255 different sets of engineering unit conversions. Each engineering unit conversion shall include range, span, and conversion equation.

#### **2.16.7 Logic (Virtual) Points**

Logic (virtual) points shall be software points entered in the point database which are not directly associated with a physical I/O function. This value shall be created by calculating it from any combination of digital and analog points, or other data. Logic points shall be analog or digital points having all the properties of real points, including alarms, without the associated hardware. Logic points shall be defined or calculated and entered into the database by the Contractor as required. The calculated analog point shall have point identification in the same format as any other analog point. The calculated point shall be used in any program where the real value is not obtainable directly. Calculated point values shall be current for use by the system within 30 seconds of the time any input value changes and shall include:

- a. Control loop setpoints.
- b. Control loop gain constants.
- c. Control loop integral constants.
- d. Summer/winter operation.
- e. Real time.
- f. Scheduled on/off times.
- g. Equipment run-time targets.
- h. Calculated point values.

#### **2.16.8 I/O Point Definition**

Each I/O point shall be defined in a database in the DDC panel. The definition shall include all physical parameters and constraints associated with each point.

#### **2.16.9 Parameter Definition**

Each I/O point shall be defined and entered into the database by the Contractor, including as applicable:

- a. Name.
- b. Device or sensor type (i.e., sensor, control, motors).
- c. Point identifications number.
- d. Area.
- e. Sensor range.



- f. Controller range.
- g. Sensor span.
- h. Controller span.
- i. Engineering units conversion (scale factor).
- j. High and low reasonableness value (analog).
- k. High and low alarm limit (analog).
- l. High and low alarm limit differential (return to normal).
- m. Analog change differential (for reporting).
- n. High accumulator limit (pulse).
- o. Status description (digital inputs).

#### **2.16.10 Alarm Processing**

Each DDC panel shall have alarm processing software for digital, analog, and pulse accumulator alarms for all input and virtual points connected to that DDC panel.

##### **2.16.10.1 Digital Alarms Definition**

Digital alarms are those abnormal conditions indicated by digital inputs as specified in the I/O Summary Tables and elsewhere.

##### **2.16.10.2 Analog Alarms Definition**

Analog alarms are those conditions higher or lower than a defined value, as measured by an analog input as specified in the I/O Summary Tables and elsewhere. Analog readings shall be compared to predefined high and low limits, and alarmed each time a value enters or returns from a limit condition. Unique high and low limits shall be assigned to each analog point in the system. Analog alarm limits shall be stored in the DDC panel database.

Each analog alarm limit shall have an associated unique limit differential specifying the amount by which a variable must return to the proper operating range before being declared as a return-to-normal state. Limits and differentials shall be entered on line by the operator in limits or the measured variable, without interruption or loss of monitoring of the point concerned.

##### **2.16.10.3 Pulse Accumulator Alarms Definition**

Pulse accumulator alarms are those conditions calculated from totalized values of accumulator inputs or pulse accumulator inputs rates that are outside defined limits as specified in the I/O Summary Tables and elsewhere. Pulse accumulator totalized values shall be compared to predefined limits and alarmed each time a value enters a limit condition. Unique limits shall be assigned to each pulse accumulator point in the system. Limits shall be stored in the DDC panel database.

##### **2.16.10.4 Equipment Constraints Definitions**

Each control point in the database shall have DDC panel resident constraints defined and entered by the Contractor, including as applicable:

- a. Minimum off time.
- b. Minimum on time.
- c. High limit (value in engineering units).
- d. Low limit (value in engineering units).

#### **2.16.10.5 Constraint Checks**

Control devices connected to the system shall have the DDC panel memory resident constraints checked before each command is issued to ensure that no equipment damage will result from improper operation. Each command shall be executed by the DDC panel only after all constraint checks have been passed. Each command point shall have unique constraints assigned. High and low "reasonableness" values or one differential "rate-of-change" value shall be assigned to each analog input. Values outside the reasonableness limits shall be rejected and an alarm generated. Status changes and analog point values shall be reported upon request, such as for reports, and application programs. Each individual point shall be capable of being selectively disabled by the operator. Disabling a point shall prohibit monitoring and automatic control of that point.

#### **2.16.11 DDC Panel Diagnostics**

Each DDC panel shall have self-test diagnostic routines implemented in firmware. The tests shall include routines that exercise memory. Diagnostic software shall be provided for use in the portable tester. The software shall display messages in plain language to inform the tester's operator of diagnosed problems.

#### **2.16.12 Summer/Winter Operation Monitoring**

The system shall provide software to change the operating parameters, monitoring of alarm limits, and start-stop schedules for each mechanical system where such a change from summer to winter and vice versa is meaningful. The software shall provide commands to application programs to coordinate summer or winter operation.

#### **2.16.13 Control Sequences and Control Loops**

Operator commands shall be used to create and execute control sequences and control loops for automated control of equipment based on operational parameters including times and events, defined in the database. Through the command entry device, the system shall prompt the operator for information necessary to create, modify, list, and delete control sequences and Proportional-plus-Integral-plus Derivative (PID) control loops. The system shall prompt the operator for confirmation that the control sequence and control loop addition/modification/deletion is correct, prior to placing it in operation. Mathematic functions required shall be available for use in creating the control sequences and control loops. Sufficient spare memory shall be provided to allow four control sequences and four control loops in addition to those necessary to implement the requirements specified for each DDC panel. Each control sequence shall accommodate up to eight terms or devices.

#### **2.16.13.1 Control Functions**

The DDC panel shall provide the following control functions:

a. PID Control

The system shall provide for PID control. The control algorithm intended for use shall be submitted for approval with a full explanation of its functions and limitations. A determination shall be made of the antiwindup limit for the DDC panel software (for example, an antiwindup limit of plus/minus one half of the actuator range).

b. Two Position Control

This function shall provide control for two state device control by comparing a setpoint against a process variable and an established deadband.

c. Floating Point Control

This function shall exercise control when an error signal exceeds a selected deadband, and shall maintain control until the error is within the deadband limits.

d. Signal Selection

This function shall allow the selection of the highest or lowest analog value from a group of analog values as the basis of control. The function shall include the ability to cascade analog values so that large numbers of inputs, up to a maximum of 20, can be reduced to one or two outputs.

e. Reset Function

This function shall develop an analog output based on up to two analog inputs and one operator specified reset schedule.

f. Self Tuning

The controller shall provide self tuning operation to proportional, integral and derivative modes of control and shall modify the mode constants as required.

#### **2.16.13.2 DDC Panel Resident Applications Software**

Application software required to achieve the sequences of operation, parameters, constraints, and interlocks necessary to provide control of the systems connected to the DDC system shall be provided. Application software shall be resident and executing in the DDC panel, and shall be coordinated to ensure that no conflicts or contentions remain unresolved.

The following Optimum Start/Stop Program software shall be provided in addition to that required elsewhere:

HVAC equipment which is required to be started and stopped based on a time schedule shall be subject to this program. The program shall take into account the thermal characteristics of the structure, indoor and outdoor air conditions using prediction software to determine the minimum time of HVAC system operation needed to satisfy space environmental requirements at the start of the occupied cycle, and determine the earliest time for stopping equipment at the day's end without allowing the space environmental conditions to drift out of the range specified for the occupied cycle before the start of the unoccupied cycle.

#### **2.16.14 Communication Programs**

The DDC panels shall be equipped with software drivers and handlers which allow for communication with the existing zone EMCS. The software drivers shall allow for communications via modems, line drivers, transmitters/receivers over LAN, wirelines, fiber optic or coaxial cables. The software shall be structured to support communication over a network with star, ring, radial, or a combination of topologies. Each communication program module shall be functionally independent of other Contractor-furnished software, to allow for future upgrade or replacement of communication modules without affecting other application programs and other software modules. Communication protocol for communication shall conform to a standard communication protocol.

### **2.17 WIRE AND CABLE**

#### **2.17.1 Digital Functions**

Control wiring for digital functions shall be 18 AWG minimum with 600-volt insulation. Multiconductor wire shall have an outer jacket of polyvinyl chloride (PVC).

#### **2.17.2 Analog Functions**

Control wiring for analog functions shall be 18 AWG minimum with 600-volt insulation, twisted and shielded, 2-, 3-, or 4-wire to match analog function hardware. Multiconductor wire shall have an outer jacket of PVC.

#### **2.17.3 Sensor Wiring**

Sensor wiring shall be 20 AWG minimum twisted and shielded, two-, three-, or four-wire to match analog function hardware. Multiconductor wire shall have an outer jacket of PVC.

#### **2.17.4 Class 2 Low Energy Conductors**

The conductor sizes specified for digital and analog functions shall take precedence over any requirements for Class 2 low energy remote-controlled and signal-circuit conductors specified elsewhere.

### **PART 3 EXECUTION**

#### **3.1 GENERAL INSTALLATION CRITERIA**

##### **3.1.1 HVAC Control System**

The HVAC control system shall be completely installed and ready for operation. Dielectric isolation shall be provided where dissimilar metals are used for connection and support. Penetrations through and mounting holes in the building exterior shall be made watertight. The HVAC control system installation shall provide clearance for control system maintenance by maintaining access space between coils, access space to mixed-air plenums, and other access space required to calibrate, remove, repair, or replace control system devices. The control system installation shall not interfere with the clearance requirements for mechanical and electrical system maintenance.

##### **3.1.2 Software Installation**

Software shall be loaded for an operational system, including databases for all points, operational parameters, and system, command, and application software. The Contractor shall provide original and backup copies of source,

excluding the general purpose operating systems and utility programs furnished by computer manufacturers and the non-job-specific proprietary code furnished by the system manufacturer, and object modules for all software on each type of media utilized, within 30 days of formal Government acceptance. In addition, a copy of individual floppy disks of all software for each DDC panel shall be provided.

### **3.1.3 Device-Mounting Criteria**

Devices mounted in or on piping or ductwork, on building surfaces, in mechanical/electrical spaces, or in occupied space ceilings shall be installed in accordance with manufacturer's recommendations and as shown. Control devices to be installed in piping and ductwork shall be provided with all required gaskets, flanges, thermal compounds, insulation, piping, fittings, and manual valves for shutoff, equalization, purging, and calibration. Strap-on temperature sensing elements shall not be used except as specified.

### **3.1.4 Wiring Criteria**

Wiring external to control panels, including low-voltage wiring, shall be installed in metallic raceways. Wiring shall be installed without splices between control devices and DDC panels. Instrumentation grounding shall be installed as necessary to prevent ground loops, noise, and surges from adversely affecting operation of the system. Cables and conductor wires shall be tagged at both ends, with the identifier shown on the shop drawings, in accordance with the requirements of Section 16415 ELECTRICAL WORK, INTERIOR. Other electrical work shall be as specified in Section 16415 ELECTRICAL WORK, INTERIOR and as shown.

## **3.2 CONTROL-SYSTEM INSTALLATION**

### **3.2.1 Damper Actuators**

Actuators shall not be mounted in the air stream. Multiple actuators operating a common damper shall be connected to a common drive shaft. Actuators shall be installed so that their action shall seal the damper to the extent required to maintain leakage at or below the specified rate and shall move the blades smoothly.

### **3.2.2 Room-Instrument Mounting**

Room instruments shall be mounted so that their sensing elements are 5 feet above the finished floor unless otherwise shown. Temperature setpoint device shall be recess mounted.

### **3.2.3 Freezestats**

For each 20 square feet of coil-face area, or fraction thereof, a freezestat shall be provided to sense the temperature at the location shown. Manual reset freezestats shall be installed in approved, accessible locations where they can be reset easily. The freezestat sensing element shall be installed in a serpentine pattern.

### **3.2.4 Averaging-Temperature Sensing Elements**

Sensing elements shall have a total element minimum length equal to 1 linear foot per square foot of duct cross-sectional area.

### **3.2.5 Duct Static-Pressure Sensing Elements and Transmitters**

The duct static-pressure sensing element and transmitter sensing point shall be located approximately two-thirds of the distance from the supply fan to the end of the duct with the greatest pressure drop.

### **3.2.6 Indication Devices Installed in Piping and Liquid Systems**

Gauges in piping systems subject to pulsation shall have snubbers. Gauges for steam service shall have pigtail fittings with cock. Thermometers and temperature sensing elements installed in liquid systems shall be installed in thermowells.

#### **3.2.6.1 Connection to Liquid and Steam Lines**

Tubing for connection of sensing elements and transmitters to liquid and steam lines shall be copper with brass compression fittings.

## **3.3 CONTROL SEQUENCES OF OPERATION**

### **3.3.1 General Requirements - HVAC System**

These requirements shall apply to all primary HVAC systems unless modified herein. The sequences describe the actions of the control system for one direction of change in the HVAC process analog variable, such as temperature, humidity or pressure. The reverse sequence shall occur when the direction of change is reversed.

#### **3.3.1.1 Supply Fan Operating**

HVAC system outside air dampers shall function as described for specific modes of operation unless control of the dampers is assumed by the fire and smoke control system. Interlocked exhaust fans shall be stopped in the unoccupied mode and their dampers shall be closed. Interlocked exhaust fans shall run in the occupied mode, and their dampers shall open. Dual temperature control valves shall function as described for the specific modes of operation unless their control is assumed by the freeze-protection system.

#### **3.3.1.2 Supply Fan Not Operating**

When an HVAC system is stopped, all interlocked fans shall stop, the outside air damper shall close and all dual temperature valves shall open to the coil.

### **3.3.2 Dual-Temperature Fan-Coil Unit**

See plans for sequence of operation.

### **3.3.3 Hydronic Heating with Hot Water Boiler**

#### **3.3.3.1 All Modes**

The DDC system shall accept a signal from a sunshielded outside air temperature sensing element and transmitter located as shown. The DDC system shall start and stop boiler pump and boiler at the outside air temperatures shown. The DDC system shall reset the hydronic-heating supply temperature setpoint in a linear schedule based on the outside air temperature as shown. The DDC system shall accept a signal from a temperature sensing element and transmitter located in the hydronic-heating supply line and the DDC system output shall modulate the hydronic-heating system control valve to maintain the reset schedule setpoint in the hydronic-heating supply line.

### **3.3.4 Dual-Temperature Hydronic**

Heating and Cooling Modes shall be selected by the DDC control system.

#### **3.3.4.1 Heating Mode**

When the heating mode is selected, the system changeover valves shall close to the central plant chilled water flow and shall open to flow to the boiler pump. Boiler system to be controlled as described hereinbefore. The DDC system shall accept a signal from a sunshielded outside air temperature sensing element and transmitter.

#### **3.3.4.2 Cooling Mode**

When the cooling mode is selected, the DDC system shall accept a signal from a temperature sensing element and transmitter located in the system return. The DDC system shall continue to operate system pump to circulate water through the system. When the system return water temperature drops below the setpoint shown, the DDC system shall allow the changeover valves to close to flow through the boiler and to open to the central plant chilled-water flow. System pump shall operate continuously.

### **3.3.5 Single Zone with Dual-Temperature Coil**

#### **3.3.5.1 Outside Air, Return Air, and Relief Air Dampers**

System On - The outside air dampers shall be open.

System Off - The dampers shall return to their normal positions.

#### **3.3.5.2 Filter**

A differential pressure switch across the filter shall initiate a filter alarm when the pressure drop across the filter reaches the setpoint as shown.

#### **3.3.5.3 Freeze Protection**

All Modes - A freezestat shall stop the supply fan, cause the outside air dampers to return to their normal position, and shall initiate a low temperature alarm if the temperature drops below the freezestat's setpoint. Return to the normal mode of operation shall require manual reset at the freezestat. The DDC panel shall monitor the freezestat through auxiliary contacts and shall indicate an alarm condition when the freezestat trips.

#### **3.3.5.4 Dual-Temperature Coil Changeover Control**

The DDC panel shall select the heating and cooling modes based on input from a temperature sensor and transmitter located in the dual-temperature supply. When the dual-temperature supply temperature is above the setpoint, the DDC panel shall operate the dual-temperature coil valve as a heating coil valve in sequence with the outside air, return air, and relief air dampers. When the dual-temperature supply temperature is below the setpoint, the DDC panel shall operate the dual-temperature coil valve as a cooling coil valve in sequence with the outside air, return air, and relief air dampers.

## **3.4 COMMISSIONING PROCEDURES**

### **3.4.1 Evaluations**

The Contractor shall make the observations, adjustments, calibrations, measurements, and tests of the control systems, set the time schedule, and

make any necessary control-system corrections to ensure that the systems function as described in the sequence of operation.

#### **3.4.1.1 Item Check**

Signal levels shall be recorded for the extreme positions of each controlled device. An item-by-item check of the sequence of operation requirement shall be performed using Steps 1 through 4 in the specified control system commissioning procedures. Steps 1, 2, and 3 shall be performed with the HVAC system shut down; Step 4 shall be performed after the HVAC systems have been started. External input signals to the DDC panel (such as starter auxiliary contacts, and external systems) may be simulated in steps 1, 2, and 3. With each operational-mode signal change, DDC panel output relay contacts shall be observed to ensure that they function.

#### **3.4.1.2 Weather-Dependent Test Procedures**

Weather-dependent test procedures that cannot be performed by simulation shall be performed in the appropriate climatic season. When simulation is used, the actual results shall be verified in the appropriate season.

#### **3.4.1.3 Two-Point Accuracy Check**

A two-point accuracy check of the calibration of each HVAC control system sensing element and transmitter shall be performed by comparing the DDC panel readout to the actual value of the variable measured at the sensing element and transmitter or airflow measurement station location. Digital indicating test instruments shall be used, such as digital thermometers, motor-driven psychrometers, and tachometers. The test instruments shall be at least twice as accurate as the specified sensing element-to-DDC panel readout accuracy. The calibration of the test instruments shall be traceable to National Institute Of Standards And Technology standards. The first check point shall be with the HVAC system in the shutdown condition, and the second check point shall be with the HVAC system in an operational condition. Calibration checks shall verify that the sensing element-to-DDC panel readout accuracies at two points are within the specified product accuracy tolerances. If not, the device shall be recalibrated or replaced and the calibration check repeated.

#### **3.4.1.4 Insertion and Immersion Temperatures**

Insertion temperature and immersion temperature sensing elements and transmitter-to-DDC panel readout calibration accuracy shall be checked at one physical location along the axis of the sensing element.

#### **3.4.1.5 Averaging Temperature**

Averaging-temperature sensing element and transmitter-to-DDC panel readout calibration accuracy shall be checked every 2 feet along the axis of the sensing element in the proximity of the sensing element, for a maximum of 10 readings. These readings shall then be averaged.

#### **3.4.2 Fan-Coil Unit**

The dual-temperature hydronic system shall be set to heating. Each space thermostat temperature setting shall be turned up so that it makes contact and turns the fan-coil unit on. It shall be ensured that the fan coil unit fan starts. Each space thermostat temperature setting shall be turned down and it shall be ensured that the fan coil unit fans stop. It shall be ensured that the valves close to flow through the coils. The dual-temperature hydronic system shall be switched to cooling. Each space thermostat temperature setting shall be turned up and it shall be ensured that contact is broken and the fan coil unit fans stop. Each space thermostat temperature setting shall



be turned down. It shall be ensured that the fan cycles from low speed to high speed as thermostat setpoint is lowered. The thermostats shall be set at their temperature setpoints. The results of testing of one of each type of unit shall be logged.

### **3.4.3 Central Plant Dual Temperature Hydronic**

Steps for installation shall be as follows:

- a. Step 1 - System Inspection: The HVAC system shall be observed in its shutdown condition. The system shall be checked to see that power and main air are available where required, and that the converter steam hot water control valve is closed.
- b. Step 2 - Calibration Accuracy Check with HVAC System Shutdown: Readings shall be taken with a digital thermometer at each temperature sensing element location. Each temperature shall be read at the DDC panel, and the thermometer and DDC panel readings logged. The calibration accuracy of the sensing element-to-DDC panel readout for outside air temperature, system supply temperature, and system return temperature shall be checked.
- c. Step 3 - Actuator Range Adjustments: A signal shall be applied to the actuator through an operator entered value to the DDC panel. The proper operation of the actuators and positioners for all valves shall be visually verified. The signal shall be varied from live zero to full range, and it shall be verified that the actuators travel from zero stroke to full stroke within the signal range. It shall be verified that all sequenced actuators move from zero stroke to full stroke in the proper direction, and move the connected device in the proper direction from one extreme position to the other.
- d. Step 4 - Control-System Commissioning:
  - (1) The two-point calibration sensing element-to-DDC panel readout accuracy check for the outside air temperature shall be performed. Any necessary software adjustments shall be made to setpoints or parameters to achieve the outside air temperature schedule.
  - (2) The system shall be indexed to the heating mode and it shall be verified that the changeover valves open to flow through the converter and close to flow from central plant chilled water.
  - (3) The outside air temperature shall be simulated through an operator entered value to be above the setpoint. It shall be verified that pump [\_\_\_\_\_] stops. A value shall be entered to simulate that the outside air temperature is below the setpoint. It shall be verified that pump [\_\_\_\_\_] starts.
  - (4) The two-point calibration accuracy check of the sensing element-to-DDC panel readout for the system-supply temperature shall be performed. The system supply temperature shall be set for the temperature schedule. Signals of 8 ma and 16 ma shall be sent to the DDC panel from the outside air temperature sensor, to verify that the system supply temperature setpoint changes to the appropriate values.
  - (5) The two-point accuracy check of the sensing element-to-DDC panel readout for the system-return temperature shall be performed. The return-water temperature setpoint shall be set to the setpoint. The system shall be placed in the occupied mode.
  - (6) The system shall be indexed to the cooling mode. It shall be verified that the converter control valve closes and that pump [\_\_\_\_\_] continues to

operate until the return water temperature falls below its setpoint, and that the changeover valves close to flow through the converter and open to flow from central plant chilled water.

(7) The system shall be placed in the unoccupied mode and it shall be verified that pump [\_\_\_\_\_] stops.

#### **3.4.4 Single Zone with Dual-Temperature Coil No Return Fan**

Steps for installation shall be as follows:

a. Step 1 - System Inspection: The HVAC system shall be verified in its shutdown condition. The system shall be checked to see that power and main air are available where required, the outside air damper, relief air damper, and cooling coil valve are closed, and that the return air damper is open.

b. Step 2 - Calibration Accuracy Check with HVAC System Shutdown: Readings shall be taken with a digital thermometer at each temperature sensing element location. Each temperature shall be read at the DDC panel, and the thermometer and DDC panel display readings logged. The calibration accuracy of the sensing element-to-DDC panel readout shall be checked for outside air, return air, and space temperatures.

c. Step 3 - Actuator Range Adjustments: A signal shall be applied to the actuator through an operator entered value at the DDC panel. The proper operation of the actuators and positioners for all dampers and valves shall be visually verified. The signal shall be varied from live zero to full range, and it shall be verified that the actuators travel from zero stroke to full stroke within the signal range. It shall be verified that all sequenced and parallel operated actuators move from zero stroke to full stroke in the proper direction and move the connected device in the proper direction from one extreme position to the other.

d. Step 4 - Control-System Commissioning:

(1) With the fan ready to start, the system shall be placed in the system on mode, and it shall be verified that supply fan starts. It shall be verified that the outside air damper is open and exhaust fan starts.

(2) The calibration accuracy check for sensing element-to-DDC panel readout for the discharge air temperature shall be performed. Setpoint shall be 70 degrees F at midpoint, 55 degrees F at the low end, and 85 degrees F at the high end. Proper operation of the temperature setpoint devices at the space temperature sensing element and transmitter location shall be verified. The temperature setpoint device shall be set to the space temperature setting as shown.

(3) Dual temperature hydronic changeover operation of aquastat shall be simulated. Control system selection of opposite season space temperature control shall be verified by artificially changing the dual temperature hydronic temperature.

(4) The system shall be placed in the off mode, and it shall be verified that the HVAC system shuts down, and the control system assumes the specified shutdown conditions.

(5) With the HVAC system running, a filter differential pressure switch input signal shall be simulated, at the device. It shall be verified that the filter alarm is initiated. The differential pressure switch shall be set at the setpoint.

(6) With the HVAC system running, a freezestat trip input signal shall be simulated, at the device. HVAC system shutdown shall be verified. It shall be verified that a low temperature alarm is initiated. The freezestat shall be set at the setpoint. The HVAC system shall be restarted by manual restart and it shall be verified that the alarm returns to normal.

(7) With the HVAC system running, a smoke detector trip input signal shall be simulated at each detector, and control-device actions and interlock functions as described in the Sequence of Operation shall be verified. Simulation shall be performed without false alarming any Life Safety systems. It shall be verified that the HVAC system shuts down and that the smoke detector alarm is initiated. The detectors shall be reset. The HVAC system shall be restarted by manual reset, and it shall be verified that the alarm returns to normal.

--End of Section--

## SECTION 15990

### TESTING, ADJUSTING AND BALANCING OF HVAC SYSTEMS

#### PART 1 GENERAL

##### 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR CONDITIONING  
ENGINEERS (ASHRAE)

ASHRAE 111 (1988) Practices for Measurement, Testing, Adjusting, and  
Balancing of Building Heating, Ventilation, Air-Conditioning  
and Refrigeration Systems

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1 (1989) National Standards for Testing and Balancing Heating,  
Ventilating, and Air Conditioning Systems

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB-01 (1991) Procedural Standards for Testing-Adjusting-Balancing  
of Environmental Systems

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION  
(SMACNA)

SMACNA-07 (1993) HVAC Systems - Testing, Adjusting and Balancing

##### 1.2 GENERAL REQUIREMENTS

The Contractor shall select AABC MN-1, NEBB-01, SMACNA-07 or ASHRAE 111 as the standard for providing testing, adjusting and balancing of air and water systems. The selected standard shall be used throughout the project. Testing, adjusting, and balancing shall be accomplished by a firm certified for testing and balancing by Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB). Prior to testing, adjusting, and balancing, the Contractor shall verify that the systems have been installed and are operating as specified. Approved detail drawings and all other data required for each system and/or component to be tested shall be made available at the jobsite during the entire testing, adjusting and balancing effort. The Contractor shall verify that all balancing devices are properly installed to permit testing, adjusting and balancing and that all duct leakage tests have been completed prior to testing, adjusting and balancing. The Contracting Officer shall be notified in writing of all equipment, components, or balancing devices, that are damaged, incorrectly installed, or missing, as well as any design deficiencies that will prevent proper testing, adjusting, and balancing. Testing, adjusting, and balancing shall not commence until approved by the Contracting Officer. Instrumentation accuracy shall be in accordance with the standard selected in this paragraph.

### **1.3 INSTRUMENT ACCURACY REQUIREMENTS**

All instrumentation shall be checked for accuracy before beginning testing, adjusting and balancing procedures. Instrument accuracy shall be in accordance with the standard selected in paragraph GENERAL REQUIREMENTS. Checks may be carried out against similar equipment maintained specifically for checking purposes or by the manufacturer or a recognized testing facility. All instrumentation used for testing shall be calibrated within 6 months of use. Pitot tubes and U-tube manometers do not require checking. In no case shall the instrumentation accuracy be less than specified by the instrument manufacturer. Any instrument falling out of calibration during the process of balancing and testing shall be recalibrated or removed from the site and replaced by a properly calibrated instrument. No instruments shall be allowed to remain on-site that are not in calibration.

### **PART 2 PRODUCTS (Not Applicable)**

### **PART 3 EXECUTION**

#### **3.1 TESTING AND BALANCING**

##### **3.1.1 General**

The facility shall be essentially complete with final ceiling, walls, windows, doors and partitions in place. Doors and windows surrounding each area to be balanced shall be closed during testing and balancing operations. Air systems shall be complete and operable with balancing dampers, ducting, diffusers, returns, flow control boxes and control components in place. Exhaust fans and fume hoods shall be operational. Hydronic systems shall be complete and operable with balancing valves, flow meters, coils, pumps, piping and control components in place. All measurements and adjustments shall be made using procedures described in standard selected in paragraph GENERAL REQUIREMENTS. Air motion and distribution from air terminals shall be as shown. Smoke tests may be used to demonstrate proper air distribution from air terminals. All data including deficiencies encountered and corrective action taken shall be recorded. If a system cannot be adjusted to meet the design requirements, the Contractor shall promptly notify the Contracting Officer in writing.

##### **3.1.2 Air Systems**

Clean filters shall be installed at the beginning of the testing, adjusting, and balancing effort. Each system shall be adjusted until all flow quantities are within plus ten percent and minus zero percent. Dampers shall be checked for tight shutoff. Air leakage around dampers shall be verified. Fire and smoke dampers shall be open. Fans shall be checked for correct direction of rotation and proper speed shall be verified. Fire and smoke dampers shall be tested at system design air flow to ensure proper closure in accordance with NFPA 90A and manufacturer's instructions prior to building occupancy.

##### **3.1.2.1 General Balancing Methods**

In addition to the requirements for specific systems, flows in supply, exhaust and return air systems shall be balanced using the methods in standard selected in paragraph GENERAL REQUIREMENTS. Throttling losses shall be limited. Air flow adjustments shall be made by first adjusting the fan speed to meet the design flow conditions. Fan speed adjustment may not be required for fan motors which are less than one horsepower, or if throttling results in no greater than an additional 1/3 horsepower draw above that required if the fan speed were adjusted. Flows and pressures shall be checked in all main risers and supply ducts at all supply, exhaust and return fan discharges. All flows shall be recorded before and after each adjustment.

### **3.1.2.2 Specific Systems**

All special or additional procedures for testing and balancing shall be in accordance with the applicable requirements of the standard selected in paragraph GENERAL REQUIREMENTS. If a system has diversity, only the required quantity of wide open terminals shall be used to meet the design air flow.

### **3.1.3 Hydronic Systems**

All valves and control components shall be open or set as required for maximum system flow. Each system shall be adjusted until all flow quantities are within the tolerances of the standard selected in paragraph GENERAL REQUIREMENTS. Pumps shall be checked for proper speed. Pump activation signal and deactivation signal valves shall be verified. Pump motor current shall be checked at maximum design flow. Variable speed pumping systems shall be tested at a minimum of four separate flow conditions to simulate design diversity.

#### **3.1.3.1 General Balancing Methods**

In addition to the requirements for specific systems, flows in piping, coils and other hydronic system components shall be balanced using the flow meter, equipment pressure drop or pump curve methods in accordance with the applicable provisions of the standard selected in paragraph GENERAL REQUIREMENTS. Flows shall be checked in all main risers and branches and condenser water lines and at all heating and cooling coils, heat exchangers, boilers, chillers, and pump discharges. Pressure taps on all pumps shall be made at factory suction and discharge tapings where available. All flows shall be recorded before and after each adjustment.

#### **3.1.3.2 Specific Systems**

Where specific systems require special or additional procedures for testing and balancing, such procedures shall be in accordance with the standard selected in paragraph GENERAL REQUIREMENTS. If a system has diversity, only the required quantity of wide-open terminals shall be used to meet the design water flow.

- a. Primary-Secondary: Primary-secondary systems shall be treated as separate systems. Primary systems shall be balanced first with the secondary systems running. Secondary systems shall then be balanced.
- b. Summer-Winter: Summer-winter systems shall be balanced in the summer mode of operation. Following completion of the summer-mode balancing, equipment used for winter operation shall be balanced.
- c. Four-Pipe Systems: Four-pipe systems shall be considered as two two-pipe systems, and balanced separately.

#### **3.1.4 Marking of Setting**

Following final acceptance of certified reports by the Contracting Officer, the setting of all HVAC adjustment devices including valves, splitters, and dampers shall be permanently marked by the testing and balancing engineer so that adjustment can be restored if disturbed at any time.

#### **3.1.5 Marking of Test Ports**

The testing and balancing engineer shall permanently and legibly mark and identify the location points of the duct test ports. If the ductwork has exterior insulation, these markings shall be made on the exterior side of the

ductwork insulation. All penetrations through ductwork and ductwork insulation shall be properly sealed to prevent air leakage or loss of vapor barrier.

### **3.2 CONTROL SYSTEMS**

Testing, adjusting, and balancing of the systems shall be coordinated with the control system installation. All control components shall be verified to be properly installed and operating as specified before proceeding with testing, adjusting, and balancing. Verification shall be in accordance with AABC MN-1.

--End of Section--

SECTION 15996  
COMMISSIONING HVAC SYSTEMS

**PART 1        GENERAL**

**1.1        SUMMARY (Not Applicable)**

**1.2        REFERENCES (Not Applicable)**

**1.3        GENERAL REQUIREMENTS**

This specification covers the commissioning of HVAC systems which are a part of this project. The purpose of commissioning is to bring the project HVAC system to a state of dynamic operation in accordance with the contract plans specifications by verifying the operation of individual components, subsystems, and systems.

**1.4        COMMISSIONING DOCUMENTATION**

The Contractor shall maintain the commissioning documentation in ring binders. The commissioning documentation shall be organized by system and subsystem when practicable. All pages shall be numbered and a table of contents page shall be provided. The commissioning documentation shall include, but not be limited to, the following.

a. Approved Test and Balance Report for the building (project) being commissioned.

b. All approved shop drawings of HVAC equipment to be commissioned. Shop drawings shall be full size sheets folded as required to fit in binders.

c. All pre-commissioning checklists initialed by indicated personnel organized by system and subsystem.

d. All functional performance test checklists signed by indicated personnel organized by system and subsystem.

e. Three copies of the Operation and Maintenance Manuals specified on other sections of these specifications shall be included with the Commissioning Documentation. The manuals shall be incorporated in the Commissioning Documentation prior to the commencement of the training required in this and other sections of the specifications. Preparation of Operation and Maintenance Manuals shall be as specified in other sections of these specifications.

**PART 2        PRODUCTS**

**2.1        MATERIALS AND EQUIPMENT**

**2.1.1      Tools and Equipment**

The Contractor shall furnish all special tools and equipment required during the commissioning process. The government will furnish necessary utilities for the commissioning process.

**PART 3        EXECUTION**

**3.1        COMMISSIONING SCHEDULE**

**3.1.1      Phase 1 - Preliminary Commissioning**

All HVAC shop drawings, including but not limited to equipment, controls, test and balance reports, operation and maintenance manuals, shall be submitted and approved by the Contracting Officer. In addition, all pre-commissioning checklists shall be completed (initialed by all parties).



### **3.1.2 Phase 2 - Functional Performance Testing**

Functional Performance Testing shall be performed as indicated on the Functional Performance Test Checklists. Functional Performance Testing shall not begin until Phase 1 of the commissioning process is complete.

#### **3.1.2.1 Functional Performance Test Notification**

The Contractor shall notify the Contracting Officer 2 weeks before functional performance testing is to begin.

### **3.1.3 Phase 3 - HVAC Training**

HVAC Training shall be conducted as indicated in the specifications for each item of equipment.

## **3.2 SYSTEM PERFORMANCE CRITERIA**

All HVAC related equipment commissioned in this section of the specifications will be evaluated based on the sequences of operation/control and the equipment schedules. Sequences of equipment operation and control and design performance data shall be as specified for the equipment item in other sections of these specifications and on the contract drawings.

## **3.3 PRE-COMMISSIONING CHECKLISTS**

### **3.3.1 Pre-Commissioning Checklists**

Pre-commissioning checklists shall be completed prior to the commencement of functional performance testing. The indicated initial is required in each location for all items, except where an "X" is shown indicating an initial is not required. See initials legend below for required initials. The pre-commissioning checklist will not be accepted as complete until all items have been initialed signifying this portion of the project is ready for Functional Performance Testing. The Contracting Officer's representative shall be the last person to initial each checklist item. The Contractor shall submit for approval a list of all Contractor and subcontractor representatives responsible for the completion of the pre-commissioning checklist phase of the project. This list of representatives shall be submitted 2 weeks prior to the installation of any HVAC equipment. Representatives may be replaced only after written approval from the Contracting Officer.

#### **3.3.1.1 Initials Legend:**

- A - General Contractor's representative.
- B - Mechanical Contractor's representative.
- C - Electrical Contractor's representative.
- D - Contracting Officer's representative.
- E - Balancing Contractor's representative.
- F - Controls Contractor's representative.

#### **3.3.1.2 Blank Pre-Commissioning Checklist**

Blank pre-commissioning checklists are in Appendix 1 located at the end of this section of the specifications.

## **3.4 FUNCTIONAL PERFORMANCE TEST CHECKLIST**

### **3.4.1 Functional Performance Test Personnel**

Functional performance testing shall be performed by a commissioning team consisting of the individuals indicated on the Functional Performance Test Checklists. The Contractor shall submit in writing a list of all Contractor and subcontractor representatives responsible for the completion of the

functional performance testing phase of the project. This list of representatives shall be submitted 2 weeks prior to commencement of functional performance testing of HVAC equipment. All representatives shall remain on the commissioning team throughout functional performance testing. Substitutions will not be permitted. Functional performance test checklists shall be completed in the presence of all commissioning team personnel at the time of the functional performance test.

#### **3.4.2 Test Implementation**

Upon failure of completion of a functional performance test checklist, the contractor shall provide a written report to the contracting officer listing the deficiencies causing the failure and remedies to correct all deficiencies. After the contractor has corrected all deficiencies, the entire functional performance test checklist for the item of equipment shall be repeated. If possible, corrections can be accomplished during the functional performance testing of equipment in other non-related systems. In any case, no system will be accepted until all equipment items in the system have complete functional performance test checklists thereby demonstrating satisfactory performance.

#### **3.4.3 Test Failure**

Failure to complete 3 functional performance test checklists constitutes failure of phase 2 of the HVAC commissioning process, however functional performance testing shall be continued to identify all failures. The Contractor shall provide a written report to the Contracting Officer listing the deficiencies causing all failures and remedies to correct all deficiencies. After correction of all deficiencies, phase 2 of the HVAC commissioning process shall be repeated in its entirety. The Contractor shall give the Contracting Officer 2 weeks notice before repeat functional performance testing is scheduled.

##### **3.4.3.1 Government Personnel**

In the event of a failure of the functional performance testing phase of the commissioning process as defined herein, the Contractor will be assessed charges to acquire Government personnel back on site for retesting observation. See SPECIAL CLAUSE paragraph entitled: HVAC COMMISSIONING FUNCTIONAL PERFORMANCE TESTING.

#### **3.4.4 Blank Functional Performance Test Checklists**

Blank functional performance test checklists are in Appendix 2 located at the end of this section of the specifications.

--End of Section--

APPENDIX 1  
PRE-COMMISSIONING CHECKLISTS

1. Pre-Commissioning Checklist - Ductwork

For Make-Up and Exhaust System served by Air Handler:

CHECKLIST ITEM	A	B	C	D	E	F
Installation						
a. Ductwork complete.	----	----	X	----	----	X
b. As-built shop drawings submitted.	----	----	X	----	----	X
c. Duct pressure and leakage test complete.	----	----	X	----	----	X
d. Fire dampers installed as required.	----	----	X	----	----	X
e. Smoke dampers installed as required.	----	----	X	----	----	----
f. Access doors and panels installed.	----	----	X	----	----	X
g. Verify open/closed status of dampers.	----	----	X	----	----	X
h. Verify Smoke dampers operation.	----	----	X	----	----	----
Test and Balance						
a. Test and Balance operation complete.	----	----	X	----	----	----

## 2. Pre-Commissioning Checklist - Make-Up System Air Handling Unit

For Air Handling Unit: \_\_\_\_\_ [fill in air handling unit symbol used on drawings]

CHECKLIST ITEM	A	B	C	D	E	F
Installation						
a. Vibration isolation devices installed.	----	----	X	----	X	X
b. Access doors are operable and sealed.	----	----	X	----	----	X
c. Casing undamaged.	----	----	X	----	X	X
d. Insulation undamaged.	----	----	X	----	X	X
e. Condensate drainage is unobstructed.	----	----	X	----	X	X
f. Fan belt adjusted.	----	----	X	----	----	X
Electrical						
a. Power available to unit disconnect.	----	----	----	----	X	----
b. Power available to unit control panel.	----	----	----	----	X	----
c. Power available to electric heating coil.	----	----	----	----	X	----
d. Proper motor rotation verified.	----	----	----	----	----	X
Coils						
a. Dual Temperature water piping properly connected and provided with balance valve, supply isolation valve, supply temperature & pressure gauge, return isolation valve, return temperature & pressure gaguges, automatic air vent.	----	----	----	----	X	----
b. Dual temperature water piping pressure tested.	----	----	X	----	X	X

## 2. Pre-Commissioning Checklist - Make-Up System Air Handling Unit

For Air Handling Unit: \_\_\_\_\_ [fill in air handling unit symbol used on drawings]

CHECKLIST ITEM	A	B	C	D	E	F
Controls						
a. Control valves/actuators properly installed.	----	----	X	----	----	----
b. Control valves/actuators operable.	----	----	X	----	----	----
c. O.A. Dampers/actuators properly installed.	----	----	X	----	----	----
d. O.A. Dampers/actuators operable.	----	----	X	----	----	----
Test and Balance (T&B)						
a. Construction filters removed and replaced.	----	----	X	----	----	X
b. T&B simulate 1/2 loaded filters.	----	----	X	----	----	X
c. T&B results +/- 10% cfm shown on drawings.	----	----	X	----	----	X
d. Test and Balance Report submitted.	----	----	X	----	----	X

### 3. Pre-Commissioning Checklist - Room Fan Coil Unit

For Fan Coil Unit:\_\_\_\_\_ [fill in air handling unit symbol used on drawings]

CHECKLIST ITEM	A	B	C	D	E	F
Installation						
a. Casing undamaged.	----	----	X	----	X	X
c. Insulation undamaged.	----	----	X	----	X	X
d. Condensate drainage is unobstructed.	----	----	X	----	X	X
2. Electrical						
a. Power available to unit disconnect.	----	----	----	----	X	X
b. Power available to unit.	----	----	----	----	X	----
c. Proper motor rotation verified.	----	----	----	----	----	X
Coils						
a. Dual temperature water piping properly connected.	----	----	X	----	----	----

### 3. Pre-Commissioning Checklist - Room Fan Coil Unit

For Fan Coil Unit:\_\_\_\_\_ [fill in air handling unit symbol used on drawings]

CHECKLIST ITEM	A	B	C	D	E	F
Controls						
a. Control valves/actuators properly installed.	----	----	X	----	----	----
b. Control valves/actuators operable.	----	----	X	----	----	----
c. Fan speed responds to thermostat.	----	----	X	----	----	----
First stage and second stage cooling.	----	----	----	----	----	----
Test and Balance (T&B)						
a. Construction filters removed and replaced.	----	----	X	----	----	----
b. T&B results +/- 10% cfm shown on drawings.	----	----	X	----	----	X
d. Test and Balance Report submitted.	----	----	X	----	----	X



## 6. Pre-Commissioning Checklist - Pumps

For Pump:\_\_\_\_\_ [fill in pump symbol used on drawings]

CHECKLIST ITEM	A	B	C	D	E	F
Installation						
a. Pumps grouted in place.			X		X	X
b. Pump vibration isolation devices functional.	----	----	X	----	X	X
c. Pump alignment verified.			X		X	X
d. Piping system installed.	----	----	X	----	X	X
e. Piping system pressure tested.	----	----	X	----	X	X
f. Pump not leaking.	----	----	X	----	X	X
Electrical						
a. Power available to pump disconnect.	----	----	----	----	X	X
b. Pump rotation verified.	----	----	----	----	X	X
c. Control system interlocks functional.	----	----	----	----	X	
Test & Balance						
a. Pressure/temperature gauges installed.	----	----	X	----		X
b. Piping system cleaned.	----	----	X	----	X	X
c. Chemical water treatment complete.	----	----	X	----	X	X
d. Water balance complete.	----	----	X	----		X
e. Water balance with design maximum flow.	----	----	X	----		X
f. Test and Balance Report submitted.	----	----	X	----		X
Related Pre-Commissioning checklists completed:						
a. Boiler.	----	----	----	----	----	----

# 10. Pre-Commissioning Checklist - Hot Water Boiler

For Boiler:\_\_\_\_\_ [fill in boiler symbol used on drawings]

CHECKLIST ITEM	A	B	C	D	E	F
Installation						
a. Boiler installed with service clearances.	----	----	X	----	----	----
b. Boiler flue installed.	----	----	X	----	----	----
c. Boiler hot water piping installed.	----	----	X	----	----	----
d. Boiler hot water piping tested.	----	----	X	----	X	----
e. Boiler makeup water piping installed.	----	----	X	----	----	----
f. Boiler gas piping installed.	----	----	X	----	X	X
g. Boiler gas piping tested.	----	----	X	----	X	X
Start-up						
a. Boiler system cleaned and filled.	----	----	X	----	----	----
b. Boiler safety/protection devices tested.	----	----	----	----	X	----
c. Boiler water treatment system functional.	----	----	X	----	X	----
d. Boiler start-up and check out complete.	----	----	X	----	X	----
Controls						
a. Hot water pump interlock installed.	----	----	----	----	X	----
b. Hot water pump interlock tested.	----	----	----	----	X	----
c. Hot water heating system balanced.	----	----	X	----	X	----
d. Hot water heating controls operational.	----	----	X	----	X	----
Related Pre-Commissioning checklists completed:						
a. Hot water pumps.	----	----	----	----	----	----
b. Test and Balance Report submitted.	----	----	X	----	----	----

# 15. Pre-Commissioning Checklist - Exhaust Fan

For Exhaust Fan:\_\_\_\_\_ [fill in exhaust fan symbol used on drawings]

CHECKLIST ITEM	A	B	C	D	E	F
1. Installation						
a. Fan belt adjusted.	----	----	X	----	----	X
2. Electrical						
a. Power available to fan disconnect.	----	----	----	----	X	----
b. Proper motor rotation verified.	----	----	----	----	----	X
Controls						
a. Control interlocks properly installed.	----	----	----	----	X	----
b. Control interlocks operable.	----	----	----	----	X	----
c. Dampers/actuators properly installed.	----	----	X	----	----	----
d. Dampers/actuators operable.	----	----	X	----	----	----
Test and Balance (T&B)						
a. T&B results +/- 10% cfm shown on drawings.	----	----	X	----	----	X
b. Test and Balance Report submitted.	----	----	X	----	----	X

# 17. Pre-Commissioning Checklist - HVAC System Controls

For HVAC System:\_\_\_\_\_ [fill in system description]

CHECKLIST ITEM	A	B	C	D	E	F
1. Installation						
a. Layout of control panel matches drawings.	----	----	X	----	X	----
b. Framed instructions mounted in or near control panel.	----	----	X	----	X	----
c. Components properly labeled (on inside and outside of panel).	----	----	X	----	X	----
d. Control components piped and/or wired to labeled terminal strip(s).	----	----	X	----	X	----
e. EMCS connection made to labeled terminal strip(s) as shown on drawings.	----	----	X	----	X	----
f. Control wiring and tubing labeled at all terminations, splices, and junctions.	----	----	X	----	X	----
g. Shielded wiring used on electronic sensors.	----	----	X	----	X	----

## Main Power and Control Air

a. 110 volt AC power available to panel.	----	----			X	----
b. 20 psig compressed air available to panel.	----	----	X		X	----

APPENDIX 2  
FUNCTIONAL PERFORMANCE TEST CHECKLISTS

1. FUNCTIONAL PERFORMANCE TEST CHECKLIST - PUMPS

For Pump: \_\_\_\_\_[fill in pump symbol used on drawings]

1. Activate pump start using control system commands (all possible combinations, on/auto, etc.). ON\_\_\_\_\_ AUTO\_\_\_\_\_ OFF\_\_\_\_\_

a) Verify pressure drop across strainer.  
STRAINER INLET PRESSURE\_\_\_\_\_psig  
STRAINER OUTLET PRESSURE\_\_\_\_\_psig

b) Verify pump inlet/outlet pressure reading, compare to Test and Balance report, pump design conditions, and pump manufacturer's performance .

	DESIGN	T&B	F.P.T.
PUMP INLET PRESSURE (psig)	_____	_____	_____
PUMP OUTLET PRESSURE (psig)	_____	_____	_____

c) Operate pump at shut-off, 50% and 100% of scheduled flow. Plot test readings on pump curve.

	SHUTOFF	50%	100%
PUMP INLET PRESSURE (psig)	_____	_____	_____
PUMP OUTLET PRESSURE (psig)	_____	_____	_____
PUMP FLOWRATE (gpm)	_____	_____	_____

2. Verify motor amperage each phase and voltage phase to phase and phase to ground.

	PHASE 1	PHASE 2	PHASE 3
AMPERAGE	_____	_____	_____
VOLTAGE	_____	_____	_____
VOLTAGE	_____	_____	_____
VOLTAGE TO GROUND	_____	_____	_____

3. Check and report unusual vibration, noise, etc.

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4. Results:

- Contractor shall record and submit results obtained in items 1 and 2 above to the contracting officer.
- If specified equipment performance is not verified, Contractor shall report remedial action required and re-schedule Functional Performance Test.

5. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

DATE: \_\_\_\_\_

General Contractor's Representative  
Mechanical Contractor's Representative  
Electrical Contractor's Representative  
Balancing Contractor's Representative  
Controls Contractor's Representative  
Contracting Officer's Representative  
Engineering Division's Representative  
Air Force's Representative

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2. FUNCTIONAL PERFORMANCE TEST CHECKLIST - Make-Up System Air Handling Unit  
For Air Handling Unit:\_\_\_\_\_ [fill in air handling unit symbol used on drawings]

1. Functional Performance Test: Contractor shall verify operation of air handling unit as per specification including the following:
  - a. Verify activation of air handling unit using control system command.  
ON\_\_\_\_\_ AUTO\_\_\_\_\_ OFF\_\_\_\_\_
  - b. The following sequence of control shall be verified during start-up:
    - 1) All dampers in normal position.\_\_\_\_\_
    - 2) All valves in normal position.\_\_\_\_\_
    - 3) System safeties allow start if safety conditions are met.\_\_\_\_\_
  - c. Normal operation.
    - 1) Outside air damper open.\_\_\_\_\_
    - 2) Return air damper open.\_\_\_\_\_
    - 3) Relief air damper closed.\_\_\_\_\_
    - 4) Dual temperature water control valve modulating to maintain discharge air temperature setpoint.\_\_\_\_\_
  - d. System shut down
    - 1) All dampers in normal position.\_\_\_\_\_
    - 2) All valves in normal position.\_\_\_\_\_
    - 3) Fan de-energizes.\_\_\_\_\_
  - e. Verify cooling coil and heating coil operation by varying thermostat setpoint from cooling setpoint to heating setpoint and returning to cooling setpoint.\_\_\_\_\_
  - f. Verify unit shut down during fire event initiated by smoke/heat sensors.\_\_\_\_\_
  - g. Verify unit shut down due to freeze-stat.\_\_\_\_\_
2. Results:
  - a. Contractor shall record and submit results obtained in item 1 above to the contracting officer.
  - b. If specified equipment performance is not verified, Contractor shall report remedial action required and re-schedule Functional Performance Test.
3. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

DATE: \_\_\_\_\_

General Contractor's Representative  
Mechanical Contractor's Representative  
Electrical Contractor's Representative  
Balancing Contractor's Representative  
Controls Contractor's Representative  
Contracting Officer's Representative  
Engineering Division's Representative  
Air Force's Representative

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3. FUNCTIONAL PERFORMANCE TEST CHECKLIST - HOT WATER BOILER

For Boiler: \_\_\_\_\_[fill in boiler symbol used on drawings]

1. Functional Performance Test: Contractor shall demonstrate operation of hot water system as per specifications including the following: Start building heating equipment to provide load for boiler. Activate controls system boiler start sequence as follows.
  - a. Start hot water pump and establish hot water flow. Verify boiler hot water proof of flow switch operation.\_\_\_\_\_
  - b. Verify control system energizes boiler start sequence.\_\_\_\_\_
  - c. Verify boiler senses hot water temperature below set point and control system activates boiler start.\_\_\_\_\_
  - d. Shut-off building heating equipment to remove load on hot water system.  
Verify boiler shut down sequence is initiated and accomplished after load is removed.\_\_\_\_\_
2. a) Verify boiler inlet/outlet pressure reading, compare to Test and Balance Report, boiler design conditions, and boiler manufacturer's performance data.

	DESIGN	T&B	F.P.T.
BOILER INLET PRESSURE (psig)	_____	_____	_____
BOILER OUTLET PRESSURE (psig)	_____	_____	_____
BOILER FLOWRATE (gpm)	_____	_____	_____
3. Record the following information:  
AMBIENT TEMPERATURE\_\_\_\_\_ F.  
ENTERING HOT WATER TEMPERATURE\_\_\_\_\_ F.  
LEAVING HOT WATER TEMPERATURE\_\_\_\_\_ F.
4. Check and report unusual vibration, noise, etc.

- 
5. Results:
    - a. Contractor shall record and submit results obtained in items 1, 2, 3, and 4 above to the contracting officer.
    - b. If specified equipment performance is not verified, Contractor shall report remedial action required and re-schedule Functional Performance Test.
  6. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

DATE: \_\_\_\_\_

General Contractor's Representative \_\_\_\_\_  
Mechanical Contractor's Representative \_\_\_\_\_  
Electrical Contractor's Representative \_\_\_\_\_  
Balancing Contractor's Representative \_\_\_\_\_  
Controls Contractor's Representative \_\_\_\_\_  
Contracting Officer's Representative \_\_\_\_\_  
Engineering Division's Representative \_\_\_\_\_  
Air Force's Representative \_\_\_\_\_



#### 4. FUNCTIONAL PERFORMANCE TEST CHECKLIST - FAN COIL UNITS

The contracting officer will select fan coil units to be spot-checked during the functional performance test. The number of units shall not exceed 10.

1. Functional Performance Test: Contractor shall demonstrate operation of selected fan coils as per specifications including the following:
  - a. Cooling only fan coils:
    - 1) Verify fan coil unit response to room temperature setpoint adjustment. Changes to be cooling setpoint to cooling setpoint minus 10 degrees and return to cooling setpoint. \_\_\_\_\_
    - 2) Check blower fan cfm. \_\_\_\_\_ cfm
    - 3) Check inlet air temperature. \_\_\_\_\_ F
    - 4) Check outlet air temperature. \_\_\_\_\_ F
  - b. Cooling/heating fan coils:
    - 1) Verify fan coil unit response to room temperature setpoint adjustment. Changes to be cooling setpoint to heating setpoint and return to cooling setpoint. \_\_\_\_\_
    - 3) Check blower fan cfm. \_\_\_\_\_ cfm
    - 4) Check cooling mode inlet air temperature. \_\_\_\_\_ F
    - 5) Check cooling mode outlet air temperature. \_\_\_\_\_ F
    - 6) Check heating mode inlet air temperature. \_\_\_\_\_ F
    - 7) Check heating mode outlet air temperature. \_\_\_\_\_ F
2. Results:
  - a. Contractor shall record and submit results obtained in item 1 above to the contracting officer.
  - b. If specified equipment performance is not verified, Contractor shall report remedial action required and re-schedule Functional Performance Test.
3. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

DATE: \_\_\_\_\_

General Contractor's Representative  
Mechanical Contractor's Representative  
Electrical Contractor's Representative  
Balancing Contractor's Representative  
Controls Contractor's Representative  
Contracting Officer's Representative

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Engineering Division's Representative  
Air Force's Representative

\_\_\_\_\_  
\_\_\_\_\_

5. FUNCTIONAL PERFORMANCE TEST CHECKLIST - HVAC Controls

The Contracting Officer will select HVAC control systems to undergo functional performance testing. The number of control panels shall not exceed 4.

For HVAC system: \_\_\_\_\_[fill in system description]

1. Functional Performance Test: Contractor shall verify operation of HVAC controls by performing the following tests:
  - a. Verify that controller is maintaining the setpoint by manually measuring the controlled variable with a thermometer, sling psychrometer, inclined manometer, etc.
  - b. Verify sensor/controller combination by manually measuring the controlled medium. Take readings from control panel display and compare readings taken manually. Record all readings.

SENSOR \_\_\_\_\_ MANUAL MEASUREMENT \_\_\_\_\_ PANEL READING VALUE \_\_\_\_\_

- c. Verify system stability by changing the controller setpoint as follows:
    1. Air Temperature- 10 degrees F
    2. Water Temperature- 10 degrees F
    3. Static Pressure- 10 percent of setpoint
    4. Relative Humidity- 10 % (RH)The control system shall be observed for 10 minutes after the change in setpoint. Instability or excessive hunting will be unacceptable.
  - d. Verify interlock with other HVAC controls.
  - e. Verify interlock with fire alarm control panel.
  - f. Verify interlock with EMCS.

2. Results:
  - a. Contractor shall record and submit results obtained in item 1 above to the contracting officer.
  - b. If specified equipment performance is not verified, Contractor shall report remedial action required and re-schedule Functional Performance Test.
3. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

DATE: \_\_\_\_\_

General Contractor's Representative  
Mechanical Contractor's Representative  
Electrical Contractor's Representative  
Balancing Contractor's Representative  
Controls Contractor's Representative  
Contracting Officer's Representative  
Engineering Division's Representative  
Air Force's Representative

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--End of Section--

## SECTION 16375

### ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND

#### PART 1 GENERAL

##### 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

##### AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C2	(1993) National Electrical Safety Code
ANSI C12.1	(1988) Code for Electricity Metering
ANSI C12.4	(1984; R 1990) Mechanical Demand Registers
ANSI C12.10	(1987) Electromechanical Watthour Meters
ANSI C12.11	(1987) Instrument Transformers for Revenue Metering, 10 kV BIL through 350 kV (0.6 kV NSV through 69 kV NSV)
ANSI C57.12.21	(1980) Requirements for Pad-Mounted Compartmental-Type, Self-Cooled, Single-Phase Distribution Transformers with High-Voltage Bushings; High-Voltage, 34 500 GrdY/19 920 Volts and Below; Low-Voltage, 240/120 Volts; 167 kVA and Smaller
ANSI C57.12.27	(1982) Conformance Requirements for Liquid-Filled Distribution Transformers Used in Pad-Mounted Installations, Including Unit Substations
ANSI C80.1	(1990) Rigid Steel Conduit - Zinc Coated
ANSI C119.1	(1986) Sealed Insulated Underground Connector Systems Rated 600 Volts

##### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 48	(1994a) Gray Iron Castings
ASTM A 123	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153	(1982; R 1987) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM B 8	(1993) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B 117	(1994) Operating Salt Spray (Fog) Testing Apparatus
ASTM C 478	(1994) Precast Reinforced Concrete Manhole Sections
ASTM D 923	(1991) Sampling Electrical Insulating Liquids
ASTM D 1654	(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

ASTM D 4059 (1991) Analysis of Polychlorinated Biphenyls in Insulating Liquids by Gas Chromatography

ASTM F 883 (1990) Padlocks

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825 (199; Supple I) Approval Guide

FEDERAL SPECIFICATIONS (FS)

FS HH-I-595 (Rev C) Insulation Tape, Electrical, Pressure-Sensitive Adhesive, Plastic

FS W-F-1814/GEN (Rev A; Am 1; Supple 1; Notice 1) Fuses, Cartridge, High-Interrupting Capacity

FS W-S-610 (Rev E) Splice Connectors

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C37.20.1 (1993) Metal-Enclosed Low-Voltage Power Circuit-Breaker Switchgear

IEEE C37.20.2 (1993; C37.20.2b) Metal-Clad and Station-Type Cubicle Switchgear

IEEE C37.20.3 (1987) Metal-Enclosed Interrupter Switchgear

IEEE C57.12.00 (1993) IEEE Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers

IEEE C57.13 (1993) Instrument Transformers

IEEE C57.98 (1993) Guide for Transformer Impulse Tests

IEEE Std 48 (1990) Standard Test Procedures and Requirements for High-Voltage Alternating-Current Cable Terminations

IEEE Std 81 (1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part1)

IEEE Std 100 (1992) IEEE Standard Dictionary of Electrical and Electronics Terms

IEEE Std 386 (1995) Separable Insulated Connector Systems for Power Distribution Systems Above 600 V

IEEE Std 404 (1993) Cable Joints for Use with Extruded Dielectric Cable Rated 5000 V through 46 000 V and Cable Joints for Use with Laminated Dielectric Cable Rated 2500 V Through 500 000 V

IEEE Std 592 (1990) Exposed Semiconducting Shields on Premolded High Voltage Cable Joints and Separable Insulated Connectors

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA AB 1 (1993) Molded Case Circuit Breakers and Molded Case Switches

NEMA FB 1	(1993) Fittings, Cast Metal Boxes and Conduit Bodies for Conduit and Cable Assemblies
NEMA SG 2	(1993) High Voltage Fuses
NEMA SG 3	(1990) Low-Voltage Power Circuit Breakers
NEMA TC 5	(1990) Corrugated Polyolefin Coilable Plastic Utilities Duct
NEMA TC 6	(1990) PVC and ABS Plastic Utilities Duct for Underground Installation
NEMA TC 7	(1990) Smooth-Wall Coilable Polyethylene Electrical Plastic Duct
NEMA WC 8	(1993) Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

#### NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1993) National Electrical Code
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#### UNDERWRITERS LABORATORIES (UL)

UL 6	(1993) Rigid Metal Conduit
UL 198E	(1988; Rev Jul 1988) Class R Fuses
UL 467	(1993) Grounding and Bonding Equipment
UL 486A	(1991; Rev Oct 1991) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 486B	(1991; Rev thru Apr 1992) Wire Connectors for Use with Aluminum Conductors
UL 489	(1991; Rev Jun 1995) Molded-Case Circuit Breakers and Circuit-Breaker Enclosures
UL 514A	(1991; Rev Apr 1995) Metallic Outlet Boxes
UL 651	(1989; Rev thru Dec 1989) Schedule 40 and 80 Rigid PVC Conduit
UL 1242	(1983; Rev thru Jul 1993) Intermediate Metal Conduit

## 1.2 GENERAL REQUIREMENTS

### 1.2.1 Terminology

Terminology used in this specification is as defined in IEEE Std 100.

### 1.2.2 Service Conditions

Items provided under this section shall be specifically suitable for the following service conditions:

- a. Fungus Control
- b. Altitude 100 feet
- c. Frequency 60

### **1.3 DELIVERY, STORAGE, AND HANDLING**

Devices and equipment shall be visually inspected by the Contractor when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced. Oil filled transformers shall be stored in accordance with the manufacturer's requirements.

### **1.4 EXTRA MATERIALS**

One additional spare fuse or fuse element for each furnished fuse or fuse element shall be delivered to the contracting officer when the electrical system is accepted. Two complete sets of all special tools required for maintenance shall be provided, complete with a suitable tool box. Special tools are those that only the manufacturer provides, for special purposes (to access compartments, or operate, adjust, or maintain special parts).

## **PART 2 PRODUCTS**

### **2.1 STANDARD PRODUCT**

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

### **2.2 NAMEPLATES**

#### **2.2.1 General**

Each major component of this specification shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a nameplate securely attached to the equipment. Nameplates shall be made of noncorrosive metal. Equipment containing liquid dielectrics shall have the type of dielectric on the nameplate. Sectionalizer switch nameplates shall have a schematic with all switch positions shown and labeled. As a minimum, nameplates shall be provided for transformers, circuit breakers, meters, switches, and switchgear.

#### **2.2.2 Liquid-Filled Transformer Nameplates**

Nameplates shall indicate percent impedance, voltage, kVA, frequency, number of phases, cooling class, insulation class, temperature rise, the number of gallons and composition of liquid-dielectric, and shall be permanently marked with a statement that the dielectric supplied is non-polychlorinated biphenyl. If transformer nameplate is not so marked, the Contractor shall furnish manufacturer's certification for each transformer that the dielectric is non-PCB classified, with less than 50 ppm PCB content in accordance with paragraph LIQUID DIELECTRICS. Certifications shall be related to serial numbers on transformer nameplates. Transformer dielectric exceeding the 50 ppm PCB content or transformers without certification will be considered as PCB insulated and will not be accepted.

## **2.3 CORROSION PROTECTION**

### **2.3.1 Aluminum Materials**

Aluminum shall not be used.

### **2.3.2 Ferrous Metal Materials**

#### **2.3.2.1 Hardware**

Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A 153 and ASTM A 123.

#### **2.3.2.2 Equipment**

Equipment and component items, including but not limited to transformer stations and ferrous metal luminaries not hot-dip galvanized or porcelain enamel finished, shall be provided with corrosion-resistant finishes which shall withstand 480 hours of exposure to the salt spray test specified in ASTM B 117 without loss of paint or release of adhesion of the paint primer coat to the metal surface in excess of 1/16 inch from the test mark. The scribed test mark and test evaluation shall be in accordance with ASTM D 1654 with a rating of not less than 7 in accordance with TABLE 1, (procedure A). Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with a zinc rich paint conforming to the manufacturer's standard.

### **2.3.3 Finishing**

Painting required for surfaces not otherwise specified and finish painting of items only primed at the factory shall be as specified in Section 09900 PAINTING, GENERAL.

## **2.4 CABLES**

Cables shall be single conductor type unless otherwise indicated.

### **2.4.1 Conductor Material**

Underground cables shall be of soft drawn copper conductor material.

### **2.4.2 Low-Voltage Cables**

Cables shall be rated 600 volts and shall conform to the requirements of NFPA 70. Cables shall utilize ethylene-propylene-rubber (EPR) insulation and shall conform to the requirements of NEMA WC 8.

#### **2.4.2.1 In Duct**

Cables shall be single-conductor cable, Type RHW, THW, THWN, TW, USE, or XHHW in accordance with NFPA 70. Cables in factory-installed, coilaible-plastic-duct assemblies shall conform to NEMA TC 5 or NEMA TC 7.

## **2.5 CABLE JOINTS, TERMINATIONS, AND CONNECTORS**

### **2.5.1 Medium-Voltage Cable Joints**

Medium-voltage cable joints shall comply with IEEE Std 404 and IEEE Std 592. Medium-voltage cable terminations shall comply with IEEE Std 48. Joints shall be the standard products of a manufacturer and shall be either of the factory preformed type or of the kit type containing tapes and other required parts.

Joints shall have ratings not less than the ratings of the cables on which they are installed. Splice kits may be of the heat-shrinkable type for voltages up to 15 kV, of the premolded splice and connector type, the conventional taped type, or the resin pressure-filled overcast taped type for voltages up to 35 kV; except that for voltages of 7.5 kV or less a resin pressure-filled type utilizing a plastic-tape mold is acceptable. Joints used in manholes, handholes, vaults and pull boxes shall be certified by the manufacturer for waterproof, submersible applications.

### **2.5.2 Medium-Voltage Separable Insulated Connectors**

Separable insulated connectors shall comply with IEEE Std 386 and IEEE Std 592 and shall be of suitable construction or standard splice kits shall be used. Separable insulated connectors are acceptable for voltages up to 35 kV. Connectors shall be of the loadbreak type as indicated, of suitable construction for the application and the type of cable connected, and shall include cable shield adaptors. Separable insulated connectors shall not be used as substitutes for conventional permanent splices. External clamping points and test points shall be provided.

### **2.5.3 Low-Voltage Cable Splices**

Low-voltage cable splices and terminations shall be rated at not less than 600 Volts. Splices in conductors No. 10 AWG and smaller shall be made with an insulated, solderless, pressure type connector, Type I, Class 1, Grade B, Style G, or Type II, Class 1 of FS W-S-610 and conforming to the applicable requirements of UL 486A. Splices in conductors No. 8 AWG and larger shall be made with noninsulated, solderless, pressure type connector, Type II, Class 2 of FS W-S-610, conforming to the applicable requirements of UL 486A and UL 486B. Splices shall then be covered with an insulation and jacket material equivalent to the conductor insulation and jacket. Splices below grade or in wet locations shall be sealed type conforming to ANSI C119.1 or shall be waterproofed by a sealant-filled, thick wall, heat shrinkable, thermosetting tubing or by pouring a thermosetting resin into a mold that surrounds the joined conductors.

### **2.5.4 Terminations**

Terminations shall be in accordance with IEEE Std 48, Class 1 or Class 2; of the molded elastomer, wet-process porcelain, prestretched elastomer, heat-shrinkable elastomer, or taped type. Acceptable elastomers are track-resistant silicone rubber or track-resistant ethylene propylene compounds, such as ethylene propylene rubber or ethylene propylene diene monomer. Separable insulated connectors may be used for apparatus terminations, when such apparatus is provided with suitable bushings. Terminations shall be of the outdoor type, except that where installed inside outdoor equipment housings which are sealed against normal infiltration of moisture and outside air, indoor, Class 2 terminations are acceptable. Class 3 terminations are not acceptable. Terminations, where required, shall be provided with mounting brackets suitable for the intended installation and with grounding provisions for the cable shielding, metallic sheath, and armor.

#### **2.5.4.1 Factory Preformed Type**

Molded elastomer, wet-process porcelain, prestretched, and heat-shrinkable terminations shall utilize factory preformed components to the maximum extent practicable rather than tape build-up. Terminations shall have basic impulse levels as required for the system voltage level. Leakage distances shall comply with wet withstand voltage test requirements of IEEE Std 48 for the next higher Basic Insulation Level (BIL) level. Anti-tracking tape shall be applied over exposed insulation of preformed molded elastomer terminations.



#### **2.5.4.2 Taped Terminations**

Taped terminations shall use standard termination kits providing terminal connectors, field-fabricated stress cones, and rain hoods. Terminations shall be at least 20 inches long from the end of the tapered cable jacket to the start of the terminal connector, or not less than the kit manufacturer's recommendations, whichever is greater.

### **2.6 CONDUIT AND DUCTS**

Duct lines shall be concrete-encased, thin-wall type. Low-voltage lines or communication lines run elsewhere may be direct-burial, thick-wall type.

#### **2.6.1 Metallic Conduit**

Intermediate metal conduit shall comply with UL 1242. Rigid galvanized steel conduit shall comply with UL 6 and ANSI C80.1. Metallic conduit fittings and outlets shall comply with UL 514A and NEMA FB 1.

#### **2.6.2 Nonmetallic Ducts**

##### **2.6.2.1 Concrete Encased Ducts**

UL 651 Schedule 40 or NEMA TC 6 Type EB.

##### **2.6.2.2 Direct Burial**

UL 651 Schedule 40 and Schedule 80, or NEMA TC 6 Type DB.

#### **2.6.3 Conduit Sealing Compound**

Compounds for sealing ducts and conduit shall have a putty-like consistency workable with the hands at temperatures as low as 35 degrees F, shall neither slump at a temperature of 300 degrees F, nor harden materially when exposed to the air. Compounds shall adhere to clean surfaces of fiber or plastic ducts; metallic conduits or conduit coatings; concrete, masonry, or lead; any cable sheaths, jackets, covers, or insulation materials; and the common metals. Compounds shall form a seal without dissolving, noticeably changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect upon the hands of workmen or upon materials.

### **2.7 MANHOLES, HANDHOLES, AND PULLBOXES**

Manholes, handholes, and pullboxes shall be as indicated. Precast-concrete manholes shall have the required strength established by ASTM C 478. Frames and covers shall be made of gray cast iron and a machine-finished seat shall be provided to ensure a matching joint between frame and cover. Cast iron shall comply with ASTM A 48, Class 30B, minimum. Handholes for low voltage cables turfed areas shall be fabricated from an aggregate consisting of sand and with continuous woven glass strands having an overall compressive strength of at least 10,000 psi and a flexural strength of at least 5,000 psi. Pullbox and handhole covers in turfed areas shall be of the same material as the box. Concrete pullboxes shall consist of precast reinforced concrete boxes, extensions, bases, and covers.

### **2.8 TRANSFORMERS, SUBSTATIONS, AND SWITCHGEAR**

Transformers, substations, and switchgear shall be of the outdoor type having the ratings and arrangements indicated. Medium-voltage ratings of cable terminations shall be 15 kV between phases for 133 percent insulation level.

### **2.8.1 Pad-Mounted Transformers**

Pad-mounted transformers shall comply with ANSI C57.12.26 and shall be of the loop feed type. Pad-mounted transformer stations shall be assembled and coordinated by one manufacturer and each transformer station shall be shipped as a complete unit so that field installation requirements are limited to mounting each unit on a concrete pad and connecting it to primary and secondary lines. Stainless steel pins and hinges shall be provided. Barriers shall be provided between high- and low-voltage compartments. High-voltage compartment doors shall be interlocked with low-voltage compartment doors to prevent access to any high-voltage section unless its associated low-voltage section door has first been opened. Compartments shall be sized to meet the specific dimensional requirements of ANSI C57.12.26. Pentahead locking bolts shall be provided with provisions for a padlock.

#### **2.8.1.1 High-Voltage Compartments**

High-voltage compartments shall be dead-front construction. Primary protection shall include loadbreak switching, drawout dry-well-mounted current-limiting fuses, and medium-voltage separable connectors, and surge arresters. Switches shall be of the group-operated type. Switches may be mounted inside transformer tanks with switch operating handles located in high-voltage compartments and equipped with metal loops for hook stick operation. Fuses shall be interlocked with switches so that fuses can be removed only when the associated switch is in the "OFF" position. Adjacent to medium-voltage cable connections, a nameplate or equivalent stenciled inscription shall be provided inscribed "DO NOT OPEN CABLE CONNECTORS UNLESS SWITCH IS OFF." Adjacent to switches, nameplates shall identify switch operating handles and "ON" and "OFF" positions. Surge arresters shall be fully insulated and configured to terminate on the same bushing as the primary cable by means of a loadbreak, feed-through bushing insert.

#### **2.8.1.2 Transformer Tank Sections**

Transformers shall comply with IEEE C57.12.00, ANSI C57.12.21, and ANSI C57.12.26 and shall be of the less-flammable, liquid-insulated type with dimethyl silicone liquid. Transformers shall be suitable for outdoor use and shall have 2 separate windings per phase. Standard NEMA primary taps shall be provided. Where primary taps are not specified, 4, 2-1/2 percent rated kVA high-voltage taps shall be provided 2 above and 2 below rated, primary voltage. Operating handles for primary tap changers for de-energized operation shall be located within high-voltage compartments, externally to transformer tanks. Adjacent to the tap changer operating handle, a nameplate or equivalent stenciled inscription shall be provided and inscribed "DO NOT OPERATE UNDER LOAD." Transformer ratings at 60 Hz shall be as follows:

Three-phase capacity.....	As Required
Impedance.....	5%
Temperature rise.....	65 degrees C
High-voltage winding.....	12,470 volts
High-voltage winding connections.....	Delta
Low-voltage winding.....	208Y/120 volts
Low-voltage winding connections.....	WYE

#### **2.8.1.3 Low-Voltage Cable Compartments**

Neutrals shall be provided with fully-insulated bushings. Clamp type cable terminations, suitable for copper conductors entering from below, shall be provided as necessary.

#### **2.8.1.4 Accessories**

High-voltage warning signs shall be permanently attached to each side of transformer stations. Voltage warning signs shall comply with ANSI C2. Copper-faced steel or stainless steel ground connection pads shall be provided in both the high- and low-voltage compartments. Dial-type thermometer, liquid-level gauge, and drain valve with built-in sampling device shall be provided for each transformer station. Insulated-bushing-type parking stands shall be provided adjacent to each separable load-break elbow to provide for cable isolation during sectionalizing operations.

### **2.9 METERING AND PROTECTIVE DEVICES**

#### **2.9.1 Circuit Breakers, Low-Voltage**

Low-voltage circuit breakers shall comply with NEMA SG 3 for power, and NEMA AB 1 and UL 489 for molded-case.

#### **2.9.2 Fuses, Medium-Voltage, Including Current-Limiting**

Medium-voltage fuses, including current-limiting, shall comply with NEMA SG 2.

#### **2.9.3 Fuses, Low-Voltage, Current-Limiting**

Low-voltage, current-limiting fuses shall comply with FS W-F-1814\GEN for Class L or UL 198E for Class R.

#### **2.9.4 Instrument Transformers**

Instrument transformers shall comply with ANSI C12.11 for 0.6 kV insulation class with a primary rating suitable for the rated voltage and current of the secondary main bus of the transformer station on which the instrument transformer is installed.

#### **2.9.5 Watthour Meters**

Metering shall consist of a socket-mounted outdoor time-of-use/demand meter mounted on the exterior of the building or if pad mounted, mount on the transformer enclosure.

The meter shall be a state-of-the-art solid-state measurement device which utilizes industrial grade electronic components. The meter shall be provided with time-of-use and with demand. The meter shall be provided with mass memory. All components of the solid-state meter, including recording capabilities, shall be enclosed on a single circuit board. The same unit will contain non-volatile memory to maintain the data integrity in the event of power loss. The meter shall have an autoranging power supply which will allow the same meter to operate at several different voltages. The meter shall be furnished to function accurately throughout the temperature range of -40 degrees C to +85 degrees C. The meters shall be available in a transformer rated or self-addressed socket mounting configuration, and a transformer rated bottom connection mounting configuration. The display shall be the LCD-seven segment type with no less than nine digits. The meter shall be programmed for operation with the use of an IBM compatible PC. The cover assembly shall be made of acrylic or lexan material and shall have a demand reset and optical port with available options such as, a keylock reset.

The solid-state meter shall utilize advanced Analog-To-Digital (A/D) conversion techniques to perform its measurements. This same unit shall

sample both the voltage and current waveforms of each phase 481 times per 60 cycles. The meter will also use a migrating sample technique to better measure harmonics.

The standard demand meter shall be capable of displaying kWh. The display of these values must be programmable up to a total of six digits with the possibility of three digits to the right of the decimal. This same unit shall be capable of being electronically detented to prevent measurement of reverse flow.

The meter shall also be capable of providing KW peak (up to the five highest peaks). With Time-Of-Use capability, both the date and time shall be capable of being provided for the five highest peaks. The meter shall be capable of either block, rolling demand intervals, or thermal emulation when calculating demand. This interval and subinterval lengths for the meter must be programmable.

#### **2.9.6 Surge Protection**

Surge protection where indicated for 120/208 volt systems on the drawings for service entrance and branch distribution panelboards shall be hard wired to the side of the panelboard. The surge protector shall have the following characteristics:

Maximum response time of 1.00 nanoseconds (turn on).

Minimum peak current surge capability of 55,000 amperes per phase (using an 8 microsecond by 20 microsecond waveform).

Let-through voltage (less than or equal to):

INPUT VOLTAGE	CAT A 200 AMPERES @ 6KV RING WAVE	CAT B 500 AMPERES @ 6KV RING WAVE	CAT B 3000 AMPERES @ 6KV RING WAVE
L-N 6,000V peak	150 Volts	350 Volts	420 Volts
L-N 1,000V peak	25 Volts	75 Volts	280 Volts

Let-Through voltage test values shall be based on the following parameters:

- Dynamic test.
- Positive polarity test.
- Tested at 180 degree phase angle.
- Tested with 6" lead length.
- All let-through voltage values shown are peak voltage test values.
- Let-through voltage values shall be obtained in compliance with ANSI/IEEE C62.41 and C62.45 except that testing shall be at 180 degrees phase angle.

Surge protectors shall be UL 1449 listed.

The following protection modes shall be provided:

- Normal mode (L-N & L-L)
- Common mode (N-G & L-G)
- Bidirectional (Positive and Negative Impulse Protection).

The suppression circuit shall be totally encapsulated in a chemical compound.

Surge protectors shall be warranted for a minimum period of five years from the date of installation.

Surge protectors shall be coordinated with the panelboards and/or loadcenters regarding voltage and number of phases, panelboards, conduit, toggle switches, receptacles, plates, etc., removed from the existing system.

## **2.10 GROUNDING AND BONDING**

### **2.10.1 Driven Ground Rods**

Ground rods shall be copper-clad steel conforming to UL 467 not less than  $\frac{3}{4}$  inch in diameter by 10 feet in length. Sectional type rods may be used.

### **2.10.2 Grounding Conductors**

Grounding conductors shall be bare, except where installed in conduit with associated phase conductors. Insulated conductors shall be of the same material as phase conductors and green color-coded, except that conductors shall be rated no more than 600 volts. Bare conductors shall be ASTM B 8 soft-drawn unless otherwise indicated. Aluminum is not acceptable.

## **2.11 CONCRETE AND REINFORCEMENT**

Concrete shall be a minimum of 2500 psi at 28 days. All other requirements shall be as specified in Section 03300 CONCRETE FOR BUILDING CONSTRUCTION. Concrete reinforcing shall be as specified in Section 03200 CONCRETE REINFORCEMENT.

## **2.12 PADLOCKS**

Padlocks shall conform to ASTM F 883, Type EPC, size 2-1/2.

## **2.13 CABLE FIREPROOFING SYSTEMS**

Cable fireproofing systems shall be listed in FM P7825 as a fire-protective coating or tape approved for grouped electrical conductors and shall be suitable for application on the type of medium-voltage cables provided. After being fully cured, materials shall be suitable for use where exposed to oil, water, gases, salt water, sewage, and fungus and shall not damage cable jackets or insulation. Asbestos materials are not acceptable.

### **2.13.1 Fireproof Coating**

Cable fireproofing coatings shall be compounded of water-based thermoplastic resins, flame-retardant chemicals, and inorganic noncombustible fibers and shall be suitable for the application methods used. Coatings applied on bundled cables shall have a derating factor of less than 5 percent, and a dielectric strength of 95 volts per mil minimum after curing.

### **2.13.2 Fireproofing Tape**

Fireproofing tape shall be at least 2 inches wide and shall be a flexible, conformable, polymeric, elastomer tape designed specifically for fireproofing cables.

### **2.13.3 Plastic Tape**

Preapplication plastic tape shall be pressure sensitive, 10 mil thick, conforming to FS HH-I-595.

## **2.14 LIQUID DIELECTRICS**

Liquid dielectrics for transformers, capacitors, reclosers, and other liquid-filled electrical equipment shall be non-polychlorinated biphenyl (PCB)

mineral-oil or less-flammable liquid as specified. Nonflammable fluids shall not be used. Tetrachloroethylene (perchloroethylene) and 1, 2, 4 trichlorobenzene fluids shall not be used. Liquid dielectrics in retrofitted equipment shall be certified by the manufacturer as having less than 50 parts per million (ppm) PCB content. In lieu of the manufacturer's certification, the Contractor may submit a test sample of the dielectric in accordance with ASTM D 923 and have tests performed per ASTM D 4059 at a testing facility approved by the Contracting Officer. Equipment with test results indicating PCB level exceeding 50 ppm shall be replaced.

## **2.15 FACTORY TESTS**

Factory tests shall be performed, as follows, in accordance with the applicable publications and with other requirements of these specifications. The Contracting Officer shall be notified at least 10 days before the equipment is ready for testing. The Contracting Officer reserves the right to witness the tests.

a. Transformers: Manufacturer's standard routine tests in accordance with IEEE C57.12.00.

b. Transformers rated 200 kVA and above: Reduced full-wave, chopped-wave, and full-wave impulse test on each line and neutral terminal, in accordance with IEEE C57.98.

c. Relaying Current Transformers: Manufacturer's standard tests in accordance with IEEE C57.13.

d. Instrument Current Transformers: Manufacturer's standard tests in accordance with IEEE C57.13.

e. Factory Preformed Terminations: Wet withstand voltage tests in accordance with IEEE Std 48 for the next higher BIL level.

f. Outdoor Switchgear: Manufacturer's standard tests in accordance with IEEE C37.20.1, IEEE C37.20.2, and IEEE C37.20.3.

## **2.16 FENCING**

Fencing shall conform to the requirements of Section 02831 CHAIN LINK FENCE.

## **PART 3 EXECUTION**

### **3.1 GENERAL INSTALLATION REQUIREMENTS**

Equipment and devices shall be installed and energized in accordance with the manufacturer's published instructions. Steel conduits installed underground shall be installed and protected from corrosion in conformance with the requirements of Section 16415 ELECTRICAL WORK, INTERIOR. Except as covered herein, excavation, trenching, and backfilling shall conform to the requirements of Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Concrete work shall conform to the requirements of Section 03300A CONCRETE FOR BUILDING CONSTRUCTION.

#### **3.1.1 Conformance to Codes**

The installation shall comply with the requirements and recommendations of NFPA 70 and ANSI C2 as applicable.

### **3.1.2 Verification of Dimensions**

The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

### **3.1.3 Disposal of Liquid Dielectrics**

PCB-contaminated dielectrics must be marked as PCB and transported to and incinerated by an approved EPA waste disposal facility. The Contractor shall furnish certification of proper disposal. Contaminated dielectrics shall not be diluted to lower the contamination level.

## **3.2 CABLE INSTALLATION**

The Contractor shall obtain from the manufacturer an installation manual or set of instructions which addresses such aspects as cable construction, insulation type, cable diameter, bending radius, cable temperature, lubricants, coefficient of friction, conduit cleaning, storage procedures, moisture seals, testing for and purging moisture, etc. The Contractor shall then perform pulling calculations and prepare a pulling plan which shall be submitted along with the manufacturers instructions in accordance with SUBMITTALS.

### **3.2.1 Cable Installation Plan and Procedure**

Cable shall be installed strictly in accordance with the cable manufacturer's recommendations. Each circuit shall be identified by means of a fiber, laminated plastic, or non-ferrous metal tags, or approved equal, in each manhole, handhole, junction box, and each terminal. Each tag shall contain the following information; cable type, conductor size, circuit number, circuit voltage, cable destination and phase identification.

#### **3.2.1.1 Cable Inspection**

The cable reel shall be inspected for correct storage positions, signs of physical damage, and broken end seals. If end seal is broken, moisture shall be removed from cable in accordance with the cable manufacturer's recommendations.

#### **3.2.1.2 Duct Cleaning**

Duct shall be cleaned with an assembly that consists of a flexible mandrel (manufacturers standard product in lengths recommended for the specific size and type of duct) that is 1/4 inch less than inside diameter of duct, 2 wire brushes, and a rag. The cleaning assembly shall be pulled through conduit a minimum of 2 times or until less than a volume of 8 cubic inches of debris is expelled from the duct.

#### **3.2.1.3 Duct Lubrication**

The cable lubricant shall be compatible with the cable jacket for cable that is being installed. Application of lubricant shall be in accordance with lubricant manufacturer's recommendations.

#### **3.2.1.4 Cable Installation**

The Contractor shall provide a cable feeding truck and a cable pulling winch as required. The Contractor shall provide a pulling grip or pulling eye in accordance with cable manufacturer's recommendations. The pulling grip or pulling eye apparatus shall be attached to polypropylene or manilla rope

followed by lubricant front end packs and then by power cables. A dynamometer shall be used to monitor pulling tension. Pulling tension shall not exceed cable manufacturer's recommendations. The Contractor shall not allow cables to cross over while cables are being fed into duct. For cable installation in cold weather, cables shall be kept at 50 degrees F temperature for at least 24 hours before installation.

#### **3.2.1.5 Cable Installation Plan**

The Contractor shall submit a cable installation plan for all cable pulls in accordance with the detail drawings portion of paragraph SUBMITTALS. Cable installation plan shall include:

- a. Site layout drawing with cable pulls identified in numeric order of expected pulling sequence and direction of cable pull.
- b. List of cable installation equipment.
- c. Lubricant manufacturer's application instructions.
- d. Procedure for resealing cable ends to prevent moisture from entering cable.
- e. Cable pulling tension calculations of all cable pulls.
- f. Cable percentage conduit fill.
- g. Cable sidewall thrust pressure.
- h. Cable minimum bend radius and minimum diameter of pulling wheels used.
- i. Cable jam ratio.
- j. Maximum allowable pulling tension on each different type and size of conductor.
- k. Maximum allowable pulling tension on pulling device.

#### **3.2.2 Duct Line**

Low-voltage cables shall be installed in duct lines where indicated. Neutral and grounding conductors shall be installed in the same duct with their associated phase conductors.

##### **3.2.2.1 Trenching**

Trenches for direct-burial cables shall be excavated to depths required to provide the minimum necessary cable cover. Bottoms of trenches shall be smooth and free of stones and sharp objects. Where bottoms of trenches comprise materials other than sand, a 3 inch layer of sand shall be laid first and compacted to approximate densities of surrounding firm soil.

##### **3.2.2.2 Cable Burial**

Cables shall be unreeled along the sides of or in trenches and carefully placed on sand or earth bottoms. Pulling cables into direct-burial trenches from a fixed reel position will not be permitted. Where cables cross, a separation of at least 3 inches shall be provided, unless each cable circuit is protected by a nonmetallic conduit sleeve at the crossing. Where single-conductor cable is installed, all 3 phases and the neutral shall be



installed in the same sleeve. Bend radius of any cable shall be not less than 2 times the diameter of the cable. In no case shall cables be left under longitudinal tension. The first 6 inch layer of backfill shall be of sand. Machine compaction shall not be used within 6 inches of the cable.

#### **3.2.2.3 Other Requirements**

Where direct-burial cables cross under roads or other paving exceeding 5 feet in width, such cables shall be installed in concrete-encased ducts. Cables may be pulled into duct from a fixed reel where suitable rollers are provided in the trench. If paving in place where cables are to be installed, coated rigid steel conduits driven under the paving may be used in lieu of concrete-encased ducts. Damage to conduit coatings shall be prevented by providing ferrous pipe jackets or by predrilling. Where cuts are made in any paving, the paving and subbase shall be restored to their original condition.

#### **3.2.2.4 Medium-Voltage Cable Joints or Low-Voltage Cable Splices**

Cable joints or splices in direct-burial cables are not permitted in runs of 1000 feet or less, nor at intervals of less than 1000 feet in longer runs, except as required for taps. Locations of cable joints or splices in shorter intervals, where required to avoid obstructions or damage to cables, shall be approved. Cable joints or splices in direct burial installations shall be installed in above-ground junction boxes or in cast metal splice boxes suitable for direct burial use. Cable joints or splices in duct banks shall be made only in manholes, handholes, or pullboxes.

#### **3.2.2.5 Cable Markers**

Markers shall be located near the ends of cable runs, at each cable joint or splice, at approximately every 500 feet along cable runs, and at changes in direction of cable runs. In addition to markers, a 5 mil, brightly colored plastic tape not less than 3 inches in width and suitably inscribed at not more than 10 feet on centers, or other approved dig-in warning indication, shall be placed approximately 12 inches below finished grade levels of trenches.

### **3.3 CABLE JOINTS**

Medium-voltage cable joints shall be made by qualified cable splicers only. Qualifications of cable splicers shall be submitted in accordance with paragraph SUBMITTALS. Shields shall be applied as required to continue the shielding system through each entire cable joint. Shields may be integrally molded parts of preformed joints. Shields shall be grounded at each joint or in accordance with manufacturer's recommended practice. Cable joints shall provide insulation and jacket equivalent to that of the associated cable. Armored cable joints shall be enclosed in compound-filled, cast-iron or alloy, splice boxes equipped with stuffing boxes and armor clamps of a suitable type and size for the cable being installed.

### **3.4 DUCT LINES**

#### **3.4.1 Requirements**

Numbers and sizes of ducts shall be as indicated. Duct lines shall be laid with a minimum slope of 4 inches per 100 feet. Depending on the contour of the finished grade, the high-point may be at a terminal. Short-radius manufactured 90-degree duct bends may be used only for equipment risers, unless specifically indicated as acceptable. The minimum manufactured bend radius shall be 18 inches for ducts of less than 3 inch diameter, and 36 inches for ducts 3 inches or greater in diameter. Otherwise, long sweep bends having a minimum radius of 25 feet shall be used for a change of direction of

more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends, but the maximum curve used shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end bells whenever duct lines terminate.

#### **3.4.2 Treatment**

Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and match factory tapers. A coupling recommended by the duct manufacturer shall be used whenever an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

#### **3.4.3 Concrete Encasement**

Ducts requiring concrete encasements shall comply with NFPA 70, except that electrical duct bank configurations for ducts 6 inches in diameter shall be determined by calculation and as shown on the drawings. The separation between adjacent electric power and communication ducts shall conform to ANSI C2. Duct line encasements shall be monolithic construction. Where a connection is made to a previously poured encasement, the new encasement shall be well bonded or doweled to the existing encasement. The Contractor shall submit proposed bonding method for approval in accordance with the detail drawing portion of paragraph SUBMITTALS. At any point, except railroad and airfield crossings, tops of concrete encasements shall be not less than the cover requirements listed in NFPA 70. Where ducts are jacked under existing pavement, rigid steel conduit will be installed because of its strength. To protect the corrosion-resistant conduit coating, predrilling or installing conduit inside a larger iron pipe sleeve (jack-and-sleeve) is required. Separators or spacing blocks shall be made of steel, concrete, plastic, or a combination of these materials placed not farther apart than 4 feet on centers. Ducts shall be securely anchored to prevent movement during the placement of concrete and joints shall be staggered at least 6 inches vertically.

#### **3.4.4 Nonencased Direct-Burial**

Top of duct lines shall be below the frost line depth of 18 inches, but not less than 36 inches below finished grade and shall be installed with a minimum of 3 inches of earth around each duct, except that between adjacent electric power and communication ducts, 12 inches of earth is required. Bottoms of trenches shall be graded toward manholes or handholes and shall be smooth and free of stones, soft spots, and sharp objects. Where bottoms of trenches comprise materials other than sand, a 3 inch layer of sand shall be laid first and compacted to approximate densities of surrounding firm soil before installing ducts. Joints in adjacent tiers of duct shall be vertically staggered at least 6 inches. The first 6 inch layer of backfill cover shall be sand compacted as previously specified. The rest of the excavation shall be backfilled and compacted in 3 to 6 inch layers. Duct banks may be held in alignment with earth. However, high-tiered banks shall use a wooden frame or equivalent form to hold ducts in alignment prior to backfilling.

#### **3.4.5 Installation of Couplings**

Joints in each type of duct shall be made up in accordance with the manufacturer's recommendations for the particular type of duct and coupling selected and as approved.

#### **3.4.5.1 Plastic Duct**

Duct joints shall be made by brushing a plastic solvent cement on insides of plastic coupling fittings and on outsides of duct ends. Each duct and fitting shall then be slipped together with a quick 1/4-turn twist to set the joint tightly.

#### **3.4.6 Duct Line Markers**

Duct line markers shall be provided at the ends of long duct line stubouts or for other ducts whose locations are indeterminate because of duct curvature or terminations at completely below-grade structures. In addition to markers, a 5 mil brightly colored plastic tape, not less than 3 inches in width and suitably inscribed at not more than 10 feet on centers with a continuous metallic backing and a corrosion-resistant 1 mil metallic foil core to permit easy location of the duct line, shall be placed approximately 12 inches below finished grade levels of such lines.

### **3.5 MANHOLES, HANDHOLES, AND PULLBOXES**

#### **3.5.1 Handholes**

Handholes shall be located approximately as shown. Handholes shall be of the type noted on the drawings and shall be constructed in accordance with the details shown.

#### **3.5.2 Pullboxes**

Pullbox tops shall be flush with sidewalks or curbs or placed 1/2 inch above surrounding grades when remote from curbed roadways or sidewalks. Covers shall be marked "Low-Voltage" and provided with 2 lifting eyes and 2 hold-down bolts. Each box shall have a suitable opening for a ground rod. Conduit, cable, ground rod entrances, and unused openings shall be sealed with mortar.

#### **3.5.3 Ground Rods**

A ground rod shall be installed at the manholes, handholes and pullboxes. Ground rods shall be driven into the earth before the manhole floor is poured so that approximately 4 inches of the ground rod will extend above the manhole floor. When precast concrete manholes are used, the top of the ground rod may be below the manhole floor and a No. 1/0 AWG ground conductor brought into the manhole through a watertight sleeve in the manhole wall.

### **3.6 PAD-MOUNTED EQUIPMENT INSTALLATION**

Pad-mounted equipment, shall be installed on concrete pads in accordance with the manufacturer's published, standard installation drawings and procedures, except that they shall be modified to meet the requirements of this document. Units shall be installed so that they do not damage equipment or scratch painted or coated surfaces. After installation, surfaces shall be inspected and scratches touched up with a paint or coating provided by the manufacturer especially for this purpose. Three-phase transformers shall be installed with ABC/123 phase sequence. Primary taps shall be set as required to maintain voltage at full load.

#### **3.6.1 Concrete Pads**

##### **3.6.1.1 Construction**

Concrete pads for pad-mounted electrical equipment shall be poured-in-place. Pads shall be constructed as indicated, except that exact pad dimensions and

mounting details are equipment specific and are the responsibility of the Contractor. Tops of concrete pads shall be level and shall project 4 inches above finished paving or grade and sloped to drain. Edges of concrete pads shall have 3/4 inch chamfer. Conduits for primary, secondary, and grounding conductors shall be set in place prior to placement of concrete pads. Where grounding electrode conductors are installed through concrete pads, PVC conduit sleeves shall be installed through the concrete to provide physical protection. To facilitate cable installation and termination, the concrete pad shall be provided with a rectangular hole below the primary and secondary compartments, sized in accordance with the manufacturer's recommended dimensions. Upon completion of equipment installation the rectangular hole shall be filled with masonry grout.

#### **3.6.1.2 Concrete and Reinforcement**

Concrete work shall comply with the requirements of Section 03300 CONCRETE FOR BUILDING CONSTRUCTION. Concrete pad reinforcement shall be in accordance with Section 03200 CONCRETE REINFORCEMENT.

#### **3.6.1.3 Sealing**

When the installation is complete, the Contractor shall seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals shall be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

#### **3.6.2 Padlocks**

Padlocks shall be provided for pad-mounted equipment and for each fence gate. Padlocks shall be keyed as directed by the Contracting Officer] Padlocks shall comply with ASTM F 883, Type EPC, Size 2-1/2.

### **3.7 CONNECTIONS BETWEEN AERIAL AND UNDERGROUND SYSTEMS**

Connections between aerial and underground systems are existing as shown.

### **3.8 CONNECTIONS TO BUILDINGS**

Cables shall be extended into the various buildings as indicated, and shall be connected to the first applicable termination point in each building. Interfacing with building interior conduit systems shall be at conduit stubouts terminating 5 feet outside of a building and 2 feet below finished grade as specified and provided under Section 16415 ELECTRICAL WORK, INTERIOR. After installation of cables, conduits shall be sealed with caulking compound to prevent entrance of moisture or gases into buildings.

### **3.9 GROUNDING**

A ground ring consisting of the indicated configuration of bare copper conductors and driven ground rods shall be installed around pad-mounted equipment as shown. Equipment frames of metal-enclosed equipment, and other noncurrent-carrying metal parts, such as cable shields, cable sheaths and armor, and metallic conduit shall be grounded. At least 2 connections shall be provided from the transformer to the ground ring. Metallic frames and covers of handholes and pull boxes shall be grounded by use of a braided, copper ground strap with equivalent ampacity of No. 6 AWG.

### **3.9.1 Grounding Electrodes**

Grounding electrodes shall be installed as shown on the drawings and as follows:

- a. Driven rod electrodes - Unless otherwise indicated, ground rods shall be driven into the earth until the tops of the rods are approximately 1 foot below finished grade.
- b. Ground ring - A ground ring shall be installed as shown consisting of bare copper conductors installed 18 inches, plus or minus 3 inches, below finished top of soil grade. Ground ring conductors shall be No. 2 AWG, minimum.
- c. Additional electrodes - When the required ground resistance is not met, additional electrodes shall be provided interconnected with grounding conductors to achieve the specified ground resistance. The additional electrodes will be up to three, 10 feet rods spaced a minimum of 10 feet apart, up to 30 feet long, driven perpendicular to grade. In high ground resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately.

### **3.9.2 Grounding and Bonding Connections**

Connections above grade shall be made by the fusion-welding process or with bolted solderless connectors, in compliance with UL 467, and those below grade shall be made by a fusion-welding process. Where grounding conductors are connected to aluminum-composition conductors, specially treated or lined copper-to-aluminum connectors suitable for this purpose shall be used.

### **3.9.3 Grounding and Bonding Conductors**

Grounding and bonding conductors include conductors used to bond transformer enclosures and equipment frames to the grounding electrode system. Grounding and bonding conductors shall be sized as shown, and located to provide maximum physical protection. Bends greater than 45 degrees in ground conductors are not permitted. Routing of ground conductors through concrete shall be avoided. When concrete penetration is necessary, nonmetallic conduit shall be cast flush with the points of concrete entrance and exit so as to provide an opening for the ground conductor, and the opening shall be sealed with a suitable compound after installation.

### **3.9.4 Surge Arrester Grounding**

Surge arresters and neutrals shall be bonded directly to the transformer enclosure and then to the grounding electrode system with a bare copper conductor, sized as shown. Lead lengths shall be kept as short as practicable with no kinks or sharp bends.

## **3.10 FIELD TESTING**

### **3.10.1 General**

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 10 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspections recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written

record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. Field test reports shall be signed and dated by the Contractor.

### **3.10.2 Safety**

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

### **3.10.3 Ground-Resistance Tests**

The resistance of each grounding electrode each grounding electrode system shall be measured using the fall-of-potential method defined in IEEE Std 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

- a. Single rod electrode - 25 ohms.
- b. Ground ring - 5 ohms.

### **3.10.4 Low-Voltage Cable Test**

Low-voltage cable, complete with splices, shall be tested for insulation resistance after the cables are installed, in their final configuration, ready for connection to the equipment, and prior to energization. The test voltage shall be 500 volts dc, applied for one minute between each conductor and ground and between all possible combinations of conductors in the same trench, duct, or cable, with all other conductors in the same trench, duct, or conduit. The minimum value of insulation shall be:

$$R \text{ in megohms} = \frac{(\text{rated voltage in kV} + 1) \times 1000}{(\text{length of cable in feet})}$$

Each cable failing this test shall be repaired or replaced. The repaired cable shall be retested until failures have been eliminated.

### **3.10.5 Liquid-Filled Transformer Tests**

The following field tests shall be performed on all liquid-filled. Pass-fail criteria shall be in accordance with transformer manufacturer's specifications.

- a. Insulation resistance test phase-to-ground.
- b. Turns ratio test.
- c. Correct phase sequence.
- d. Correct operation of tap changer.

### **3.10.6 Pre-Energization Services**

Calibration, testing, adjustment, and placing into service of the installation shall be accomplished by a manufacturer's product field service engineer or

independent testing company with a minimum of 2 years of current product experience. The following services shall be performed on the equipment listed below. These services shall be performed subsequent to testing but prior to the initial energization. The equipment shall be inspected to ensure that installation is in compliance with the recommendations of the manufacturer and as shown on the detail drawings. Terminations of conductors at major equipment shall be inspected to ensure the adequacy of connections. Bare and insulated conductors between such terminations shall be inspected to detect possible damage during installation. If factory tests were not performed on completed assemblies, tests shall be performed after the installation of completed assemblies. Components shall be inspected for damage caused during installation or shipment to ensure packaging materials have been removed. Components capable of being both manually and electrically operated shall be operated manually prior to the first electrical operation. Components capable of being calibrated, adjusted, and tested shall be calibrated, adjusted, and tested in accordance with the instructions of the equipment manufacturer. Items for which such services shall be provided, but are not limited to, are the following:

- a. Pad-mounted transformers
- b. Panelboards

### **3.10.7 Operating Tests**

After the installation is completed, and at such times as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval.

The equipment shall be demonstrated to operate in accordance with the requirements herein. An operating test report shall be submitted in accordance with paragraph SUBMITTALS.

### **3.11 MANUFACTURER'S FIELD SERVICE**

#### **3.11.1 Onsite Training**

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 8 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The course instruction shall cover pertinent points involved in operating, starting, stopping, and servicing the equipment, as well as all major elements of the operation and maintenance manuals. Additionally, the course instructions shall demonstrate all routine maintenance operations.

#### **3.11.2 Installation Engineer**

After delivery of the equipment, the Contractor shall furnish one or more field engineers, regularly employed by the equipment manufacturer to supervise the installation of the equipment, assist in the performance of the onsite tests, initial operation, and instruct personnel as to the operational and maintenance features of the equipment.

### **3.12 ACCEPTANCE**

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

--End of Section--

## SECTION 16415

### ELECTRICAL WORK, INTERIOR

#### **PART 1 GENERAL**

##### **1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

##### AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI C37.16 (1988; C37.16a) Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors - Preferred Ratings, Related Requirements, and Application Recommendations
- ANSI C39.1 (1981; R 1992) Electrical Analog Indicating Instruments
- ANSI C82.4 (1992) Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)

##### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM D 709 (1992) Laminated Thermosetting Materials

##### CODE OF FEDERAL REGULATIONS (CFR)

- 47 CFR 18 Rules and Regulations: Industrial, Scientific, and Medical Equipment
- 47 CFR 68 Connection of Terminal Equipment to the Telephone Network

##### FEDERAL SPECIFICATIONS (FS)

- FS L-C-530 (Rev C) Coating, Pipe, Thermoplastic Resin

##### INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- IEEE C37.13 (1990) Low-Voltage AC Power Circuit Breakers Used in Enclosures
- IEEE C62.41 (1991) Surge Voltages in Low-Voltage AC Power Circuits
- IEEE Std 81 (1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)

##### INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

- ICEA S-80-576 (1988) Communications Wire and Cable for Wiring of Premises

##### NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- NEMA 250 (1991) Enclosures for Electrical Equipment (1000 Volts Maximum)
- NEMA AB 1 (1993) Molded Case Circuit Breakers and Molded Case Switches
- NEMA FU 1 (1986) Low Voltage Cartridge Fuses



NEMA ICS 1	(1993) Industrial Controls and Systems
NEMA ICS 2	(1993) Industrial Control Devices, Controllers and Assemblies
NEMA ICS 3	(1993) Industrial Systems
NEMA ICS 6	(1993) Enclosures for Industrial Control and Systems
NEMA LE 4	(1987) Recessed Luminaires, Ceiling Compatibility
NEMA MG 1	(1993; Rev 1-1993; Rev 2-1995) Motors and Generators
NEMA MG 10	(1994) Energy Management Guide for Selection and Use of Polyphase Motors
NEMA OS 1	(1989) Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports
NEMA OS 2	(1986; Errata Aug 1986; R 1991) Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports
NEMA PB 1	(1990) Panelboards
NEMA PB 2	(1989) Deadfront Distribution Switchboards
NEMA RN 1	(1989) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC 2	(1990) Electrical Polyvinyl Chloride (PVC) Tubing (EPT) and Conduit (EPC-40 and EPC-80)
NEMA TC 13	(1993) Electrical Nonmetallic Tubing (ENT)
NEMA WD 1	(1983; R 1989) General Requirements for Wiring Devices
NEMA WD 6	(1988) Wiring Devices - Dimensional Requirements

#### NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1993) National Electrical Code
NFPA 101	(1994) Safety to Life from Fire in Buildings and Structures

#### UNDERWRITERS LABORATORIES (UL)

UL-03	(1995) Electrical Construction Materials Directory
UL 1	(1993; Rev thru Jan 1995) Flexible Metal Conduit
UL 5	(1995) Surface Metal Raceways and Fittings
UL 6	(1993) Rigid Metal Conduit
UL 20	(1995) General-Use Snap Switches
UL 44	(1991; Rev thru Jan 1995) Rubber-Insulated Wires and Cables
UL 50	(1992; Rev thru Nov 1994) Enclosures for Electrical Equipment

UL 67	(1993; Rev thru Dec 1993) Panelboards
UL 83	(1991; Rev thru Oct 1994) Thermoplastic-Insulated Wires and Cables
UL 94	(1991; Rev thru Apr 1995) Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
UL 98	(1994; R Feb 1995) Enclosed and Dead-Front Switches
UL 198C	(1986; Rev thru Jun 1993) High-Interrupting-Capacity Fuses, Current-Limiting Types
UL 198D	(1995) Class K Fuses
UL 198E	(1988; Rev Jul 1988) Class R Fuses
UL 198G	(1988; Rev May 1988) Fuses for Supplementary Overcurrent Protection
UL 360	(1986; Rev thru Dec 1994) Liquid-Tight Flexible Steel Conduit
UL 467	(1993) Grounding and Bonding Equipment
UL 486A	(1991; Rev Oct 1991) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 486B	(1991; Rev thru Apr 1992) Wire Connectors for Use with Aluminum Conductors
UL 486C	(1991; Rev thru Sep 1992) Splicing Wire Connectors
UL 489	(1991; Rev thru Jun 1995) Molded-Case Circuit Breakers and Circuit-Breaker Enclosures
UL 497	(1995) Protectors for Paired Conductor Communication Circuits
UL 508	(1993) Industrial Control Equipment
UL 510	(1994) Insulating Tape
UL 512	(1993) Fuseholders
UL 514A	(1991; Rev Apr 1995) Metallic Outlet Boxes
UL 514B	(1992; Rev thru Apr 1995) Fittings for Conduit and Outlet Boxes
UL 514C	(1988; Rev Apr 1995) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 542	(1994) Lampholders, Starters, and Starter Holders for Fluorescent Lamps
UL 651	(1989; Rev thru Dec 1989) Schedule 40 and 80 Rigid PVC Conduit
UL 651A	(1995) Type EB and A Rigid PVC Conduit and HDPE Conduit

UL 674	(1994; Rev Jul 1995) Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations
UL 698	(1995) Industrial Control Equipment for Use in Hazardous (Classified) Locations
UL 719	(1985; Rev thru Dec 1994) Nonmetallic-Sheathed Cables
UL 797	(1993; Rev May 1995) Electrical Metallic Tubing
UL 869A	(1993; Rev Apr 1994) Reference Standard for Service Equipment
UL 877	(1993) Circuit Breakers and Circuit-Breaker Enclosures for Use in Hazardous (Classified) Locations
UL 886	(1994; Rev thru Jul 1995) Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations
UL 891	(1994; Rev thru Jan 1995) Dead-Front Switchboards
UL 924	(1995) Emergency Lighting and Power Equipment
UL 935	(1995; Rev Jun 1995) Fluorescent-Lamp Ballasts
UL 943	(1993; Rev thru Jan 1995) Ground-Fault Circuit Interrupters
UL 1004	(1994) Electric Motors
UL 1010	(1995) Receptical-Plug Combinations for Use in Hazardous (Classified) Locations
UL 1029	(1994; Rev Oct 1994) High-Intensity-Discharge Lamp Ballasts
UL 1570	(1988; Rev thru Mar 1995) Fluorescent Lighting Fixtures
UL 1571	(1991; Rev thru Mar 1995) Incandescent Lighting Fixtures
UL 1572	(1991; Rev thru Mar 1995) High Intensity Discharge Lighting Fixtures
UL 1660	(1994) Liquid-Tight Flexible Nonmetallic Conduit

## **1.2 GENERAL**

### **1.2.1 Rules**

The installation shall conform to the requirements of NFPA 70 and NFPA 101, unless more stringent requirements are indicated herein or shown.

### **1.2.2 Coordination**

The drawings indicate the extent and the general location and arrangement of equipment, conduit, and wiring. The Contractor shall become familiar with all details of the work and verify all dimensions in the field so that the outlets and equipment shall be properly located and readily accessible. Lighting fixtures, outlets, and other equipment and materials shall be located to avoid interference with mechanical or structural features; otherwise, lighting fixtures shall be symmetrically located according to the room arrangement when uniform illumination is required, or asymmetrically located to suit conditions

fixed by design and shown. Raceways, junction and outlet boxes, and lighting fixtures shall not be supported from sheet metal roof decks. If any conflicts occur necessitating departures from the drawings, details of and reasons for departures shall be submitted and approved prior to implementing any change. The Electrical Contractor shall coordinate the electrical work with HVAC and electrical drawings and provide all power related wiring even if they are not shown on electrical drawings.

### **1.2.3 Special Environments**

#### **1.2.3.1 Weatherproof Locations**

Wiring, Fixtures, and equipment in designated locations shall conform to NFPA 70 requirements for installation in damp or wet locations.

#### **1.2.3.2 Hazardous Locations**

Wiring and equipment in locations indicated shall be of the classes, groups, divisions, and suitable for the operating temperature; all as indicated.

### **1.2.4 Standard Products**

Material and equipment shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

### **1.2.5 Identification Nameplates**

Major items of electrical equipment and major components shall be permanently marked with an identification name to identify the equipment by type or function and specific unit number as indicated. Designation of motors shall coincide with their designation in the motor control center or panel. Unless otherwise specified, all identification nameplates shall be made of laminated plastic in accordance with ASTM D 709 with black outer layers and a white core. Edges shall be chamfered. Plates shall be fastened with black-finished round-head drive screws, except motors, or approved nonadhesive metal fasteners. When the nameplate is to be installed on an irregular-shaped object, the Contractor shall devise an approved support suitable for the application and ensure the proper installation of the supports and nameplates. In all instances, the nameplate shall be installed in a conspicuous location. At the option of the Contractor, the equipment manufacturer's standard embossed nameplate material with black paint-filled letters may be furnished in lieu of laminated plastic. The front of each panelboard, motor control center, switchgear, and switchboard shall have a nameplate to indicate the phase letter, corresponding color and arrangement of the phase conductors. The following equipment, as a minimum, shall be provided with identification nameplates:

Minimum 1/4 inch  
High Letters

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Panelboards  
Starters  
Safety Switches  
Transformers  
Equipment Enclosures  
Switchboards  
Motors

Minimum 1/8 inch  
High Letters

---

Control Power Transformers  
Control Devices  
Instrument Transformers

Each panel, section, or similar assemblies shall be provided with a nameplate in addition to nameplates listed above, which shall be provided for individual compartments in the respective assembly, including nameplates which identify "future," "spare," and "dedicated" or "equipped spaces."

#### **1.2.6 As Built Drawings**

Following the project completion or turnover, within 30 days the Contractor shall furnish two sets of as built drawings to the Contracting Officer.

#### **1.3 WORKMANSHIP**

Materials and equipment shall be installed in accordance with recommendations of the manufacturer and as shown.

### **PART 2 PRODUCTS**

#### **2.1 MATERIALS AND EQUIPMENT**

Materials and equipment shall conform to the respective publications and other requirements specified below. Materials and equipment not listed below shall be as specified elsewhere in this section.

##### **2.1.12.1.2 Cables and Wires**

Conductors in cables shall be annealed copper. Intermixing of copper and aluminum conductors in these sizes is not permitted. Design is based on copper conductors and aluminum conductors shall have an ampacity not less than that of the indicated copper conductors. Cables shall be single-conductor type, unless otherwise indicated. Cables and wires shall conform to UL 44 for rubber-insulated type; UL 83 for the thermoplastic-insulated type; and UL 719 for the nonmetallic-sheathed cables.

##### **2.1.2.1 Metallic Armored Cable**

Type ACHH or ACT.

##### **2.1.2.2 Service Entrance Cable**

Type USE.

##### **2.1.2.3 Grounding Cables**

Grounding cables shall be bare or shall have green low-voltage insulation.

##### **2.1.2.4 Telephone Cables**

ICEA S-80-576.

##### **2.1.3 Connector Blocks**

Connector blocks shall be type 66 equipped with punch down clips.

##### **2.1.4 Telephone Backboards**

Backboards shall be 5/8 inch plywood having a two-coat insulating varnish finish.

##### **2.1.5 Protector Modules**

The protector modules shall be of the three-electrode gas tube type. Protection modules shall be heavy duty as specified in REA TE&CM 823. The gas

modules shall be fail-short and shall shunt high voltage to ground in less than 10 nanoseconds, shall have an external spark gap, and shall comply with UL 497.

#### **2.1.6 Circuit Breakers**

Circuit breakers shall have voltage, current and interrupting ratings as indicated. Fully rated circuit breakers shall be provided to obtain the specified interrupting rating.

##### **2.1.6.1 Molded-Case and Insulated-Case Circuit Breakers**

NEMA AB 1 and UL 489 for circuit breakers, and UL 877 for circuit breakers and circuit breaker enclosures in hazardous (classified) locations.

a. Molded-Case Circuit Breakers: Single-pole breakers shall be full module size; two poles shall not be installed in a single module. Multipole breakers shall be of the common-trip type having a single operating handle, but for sizes of 100 amperes or less may consist of single-pole breakers permanently factory assembled into a multipole unit having an internal, mechanical, nontamperable common-trip mechanism and external handle ties. Breakers coordinated with current-limiting fuses shall have a combined interrupting capacity of 100,000 symmetrical amperes. All poles of associated breakers shall open if any fuse blows.

##### **2.1.6.2 Low-Voltage-Power**

IEEE C37.13 and ANSI C37.16. Breakers shall have continuous, short time withstand, and interrupting current ratings and frame sizes as indicated. Breakers shall have adjustable instantaneous solid state trip elements as indicated. Breakers shall be stored energy, manually operated, except solenoid operated breakers are permitted in 600 amperes frame or smaller electrically operated breakers.

##### **2.1.6.3 Ground Fault Circuit Interrupters**

UL 943. Breakers equipped with ground fault interrupters shall have ground fault class, interrupting capacity, and voltage and current ratings as indicated.

#### **2.1.7 Conduit and Tubing**

##### **2.1.7.1 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)**

UL 797.

##### **2.1.7.2 Electrical Nonmetallic Tubing (ENT)**

NEMA TC 13.

##### **2.1.7.3 Electrical Plastic Tubing and Conduit**

NEMA TC 2.

##### **2.1.7.4 Flexible Conduit, Steel and Plastic**

General-purpose type, UL 1; liquid tight, UL 360, and UL 1660.

##### **2.1.7.5 Intermediate Metal Conduit**

UL 1242.

**2.1.7.6 PVC Coated Rigid Steel Conduit**

NEMA RN 1.

**2.1.7.7 Rigid Metal Conduit**

UL 6.

**2.1.7.8 Rigid Plastic**

NEMA TC 2, UL 651 and UL 651A.

**2.1.7.9 Surface Metal Electrical Raceways and Fittings**

UL 5.

**2.1.8 Conduit and Device Boxes and Fittings**

**2.1.8.1 Boxes, Metallic Outlet**

NEMA OS 1 and UL 514A.

**2.1.8.2 Boxes, Nonmetallic, Outlet and Flush-Device Boxes and Covers**

NEMA OS 2 and UL 514C.

**2.1.8.3 Boxes, Outlet for Use in Hazardous (Classified) Locations**

UL 886.

**2.1.8.4 Boxes, Switch (Enclosed), Surface-Mounted**

UL 98.

**2.1.8.5 Fittings for Conduit and Outlet Boxes**

UL 514B.

**2.1.8.6 Fittings for Use in Hazardous (Classified) Locations**

UL 886.

**2.1.8.7 Fittings, PVC, for Use with Rigid PVC Conduit and Tubing**

UL 514B.

**2.1.9 Conduit Coatings Plastic Resin System**

FS L-C-530 or NEMA RN 1, Type A-40.

**2.1.10 Connectors, Wire Pressure**

**2.1.10.1 Copper Conductors**

UL 486A.

**2.1.10.2 Aluminum Conductors**

UL 486B.

### **2.1.11 Electrical Grounding and Bonding Equipment**

UL 467.

#### **2.1.11.1 Ground Rods**

Ground rods shall be of copper-clad steel conforming to -UL 467 not less than 3/4] inch in diameter by 10 feet in length of the sectional type driven full length into the earth.

#### **2.1.11.2 Ground Bus**

The ground bus shall be bare conductor or flat copper in one piece, if practicable.

### **2.1.12 Enclosures**

NEMA ICS 6 or NEMA 250 or UL 698 for use in hazardous (classified) locations, unless otherwise specified.

#### **2.1.12.1 Cabinets and Boxes, Volume Greater Than 100 Cubic Inches**

UL 50, hot-dip, zinc-coated, if sheet steel.

#### **2.1.12.2 Circuit Breaker**

UL 489.

#### **2.1.12.3 Circuit Breaker for Use in Hazardous (Classified) Locations**

UL 877.

### **2.1.13 Fixtures, Lighting and Fixture Accessories/Components**

Are to be selected types according to Standard Drawing 40-06-04. Fixtures, accessories and components, including ballasts, lampholders, lamps, starters and starter holders, shall conform to industry standards specified below.

#### **2.1.13.1 Fixture, Auxiliary or Emergency**

UL 924.

#### **2.1.13.2 Incandescent Fixture**

NEMA LE 4 for ceiling compatibility of recessed fixtures and UL 1571.

#### **2.1.13.3 Fluorescent**

a. Fixture: NEMA LE 4 for ceiling compatibility of recessed fixtures and UL 1570. Fixtures shall be plainly marked for proper lamp and ballast type to identify lamp diameter, wattage, color and start type. Marking shall be readily visible to service personnel, but not visible from normal viewing angles.

b. Ballasts:

(1) Electronic Ballast. Electronic ballasts shall consist of a rectifier, high frequency inverter, and power control and regulation circuitry. The ballasts shall be UL listed, Class P, with a Class A sound rating and shall contain no PCBs. Ballasts shall meet 47 CFR 18 for electromagnetic interference and shall not interfere with the operation of other electrical equipment. Design shall withstand line transients per IEEE



C62.41, Category A. Unless otherwise indicated, the minimum number of ballasts shall be used to serve each individual fixture, using one, two, three or four lamp ballasts. A single ballast may be used to serve multiple fixtures if they are continuous mounted, factory manufactured for that installation with an integral wireway and are identically controlled.

- (a) Light output regulation shall be +/- 10%.
- (b) Voltage input regulation shall be +/- 10%.
- (c) Lamp current crest factor shall be no more than 1.7.
- (d) Ballast factor shall be not less than 85% nor more than 100%, unless otherwise indicated.
- (e) A 60 Hz filter shall be provided. Flicker shall be no more than 15% with any lamp suitable for the ballast.
- (f) Ballast case temperature shall not exceed 25 degree Celsius rise above 40 degree celsius ambient, when tested in accordance with UL 935.
- (g) Input current third harmonic shall not exceed 32 percent total harmonic distortion or 27.5 percent of the third triplens.
- (h) Power factor shall not be less than 0.9.
- (i) Ballasts shall operate at a frequency of 20 KHz or more.
- (j) Operating filament voltage shall be 2.5 to 4.5 volts.
- (k) Warranty. Three year full warranty including a \$10 labor allowance.
- (l) Ballast Efficacy Factor (BEF) shall be in accordance with the following table. Ballasts and lamps shall be matching rapid start or instant start as indicated on the following table. If 32W-F32-T8 lamps and ballasts are used, they must be either all rapid start or all instant start.

#### ELECTRONIC FLUORESCENT BALLAST EFFICACY FACTOR

LAMP TYPE	TYPE OF STARTER & LAMP	NOMINAL OPERATIONAL INPUT VOLTAGE	NUMBER OF LAMPS	MIN. BALLAST EFFICACY FACTOR
40W F40 T12	rapid start	120 or 277 V	1	2.3
			2	1.2
			3	0.8
			4	0.6
34W F40 T12	rapid start	120 or 277 V	1	2.6
			2	1.3
			3	1.0
			4	0.7
40W F40 T10	rapid start	120 or 277 V	1	2.2
			2	1.1
			3	0.8
32W F32 T8	rapid or instant start	120 or 277 V	1	2.4
			2	1.4
			3	1.0
			4	0.8

For ballasts not specifically designed for use with dimming controls

The BEF is calculated using the formula:

BEF = Ballast Factor (in percent) / Power Input

Where Power Input = Total Wattage of Combined Lamps and Ballasts.

- c. Lampholders, Starters, and Starter Holders: UL 542.

#### **2.1.13.4 High-Intensity-Discharge**

- a. Fixture: NEMA LE 4 for ceiling compatibility of recessed fixtures and UL 1572.
- b. Ballasts: ANSI C82.4 for multiple supply types and UL 1029.

#### **2.1.14 Fuses and Fuseholders**

##### **2.1.14.1 Fuses, Low Voltage Cartridge Type**

NEMA FU 1.

##### **2.1.14.2 Fuses, High-Interrupting-Capacity, Current-Limiting Type**

UL 198C.

##### **2.1.14.3 Fuses, Class K, High-Interrupting-Capacity Type**

UL 198D.

##### **2.1.14.4 Fuses, Class R**

UL 198E.

##### **2.1.14.5 Fuses for Supplementary Overcurrent Protection**

UL 198G.

##### **2.1.14.6 Fuseholders**

UL 512.

##### **2.1.15 Instruments, Electrical Indicating**

ANSI C39.1.

##### **2.1.16 Motors, ac, Fractional and Integral**

Motors, ac, fractional and integral horsepower, 500 hp and smaller shall conform to NEMA MG 1 and UL 1004 for motors; NEMA MG 10 for energy management selection of polyphase motors; and UL 674 for use of motors in hazardous (classified) locations.

###### **2.1.16.1 Rating**

The horsepower rating of motors should be limited to no more than 125 percent of the maximum load being served unless a NEMA standard size does not fall within this range. In this case, the next larger NEMA standard motor size should be used.

###### **2.1.16.2 Motor Efficiencies**

All permanently wired polyphase motors of 1 hp or more shall meet the minimum full-load efficiencies as indicated in the following table, and as specified in this specification. Motors of 1 hp or more with open, dripproof or totally enclosed fan cooled enclosures shall be high efficiency type, unless otherwise indicated. Motors provided as an integral part of motor driven equipment are

excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

#### Minimum Motor Efficiencies

HP	Std. Efficiency	High Efficiency
1	77.0	85.5
1.5	78.5	85.5
2	78.5	85.5
3	78.5	88.5
5	82.5	88.5
7.5	84.0	90.0
10	85.5	90.0
15	85.5	91.0
20	87.5	92.0
25	88.5	92.0
30	88.5	92.0
40	88.5	92.0
50	89.0	92.5
60	89.0	92.5
75	89.0	95.5
100	90.0	93.5
125	91.0	94.5
150	91.0	94.5
200	91.0	94.5
250	91.0	94.5
300	91.0	94.5
350	91.0	94.5
400	91.0	94.5
500	91.0	94.5

#### **2.1.17 Motor Controls and Motor Control Centers**

NEMA ICS 1, NEMA ICS 2, NEMA ICS 3 and NEMA ICS 6, and UL 508 and UL 845.

#### **2.1.18 Panelboards**

Dead-front construction, NEMA PB 1 and UL 67.

#### **2.1.19 Receptacles**

##### **2.1.19.1 General Grade**

NEMA WD 1.

##### **2.1.19.2 Ground Fault Interrupters**

UL 943, Class A or B.

##### **2.1.19.3 Hazardous (Classified) Locations**

UL 1010.

#### **2.1.20 Service Equipment**

UL 869A.

#### **2.1.21 Splice, Conductor**

UL 486C.

#### **2.1.22 Switchboard, Dead Front Distribution**

NEMA PB 2 and UL 891.

#### **2.1.23 Snap Switches**

UL 20.

#### **2.1.24 Tapes**

##### **2.1.24.1 Plastic Tape**

UL 510.

#### **2.1.25 Wiring Devices**

NEMA WD 1 for general-purpose wiring devices, and NEMA WD 6 for dimensional requirements of wiring devices.

#### **2.1.26 Telephone Jacks**

47 CFR 68, plastic shall be class VO in accordance with UL 94.

### **PART 3 EXECUTION**

#### **3.1 GROUNDING**

Grounding shall be in conformance with NFPA 70, the contract drawings, and the following specifications.

##### **3.1.1 Ground Rods**

The resistance to ground shall be measured using the fall-of-potential method described in IEEE Std 81. The maximum resistance of a driven ground shall not exceed 25 ohms under normally dry conditions. If this resistance cannot be obtained with a single rod, 3 additional rods not less than 6 feet on centers, or if sectional type rods are used, 6 additional sections may be coupled and driven with the first rod. In high-ground-resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately. Connections below grade shall be fusion welded. Connections above grade shall be fusion welded or shall use UL 467 approved connectors.

##### **3.1.2 Ground Bus**

Ground bus shall be provided in the electrical equipment rooms as indicated. Noncurrent-carrying metal parts of electrical equipment shall be effectively grounded by bonding to the bus. The ground bus shall be bonded to both the entrance ground, and to a ground rod or rods as specified above having the upper ends terminating approximately 4 inches above the floor. Connections and splices shall be of the brazed, welded, bolted, or pressure-connector type, except that pressure connectors or bolted connections shall be used for connections to removable equipment. Connections shall be bolted type in lieu of thermoweld, so they can be changed as required by additions and/or alterations.

##### **3.1.3 Grounding Conductors**

A green ground wire shall be furnished regardless of the type of conduit. All equipment grounding conductors, including metallic raceway systems used as

such, shall be bonded or joined together in each wiring box or equipment enclosure. Metallic raceways and grounding conductors shall be checked to assure that they are wired or bonded into a common junction. Metallic boxes and enclosures, if used, shall also be bonded to these grounding conductors by an approved means per NFPA 70. When boxes for receptacles, switches, or other utilization devices are installed, any designated grounding terminal on these devices shall also be bonded to the equipment grounding conductor junction with a short jumper.

### **3.2 WIRING METHODS**

#### **3.2.1 General Requirements**

Unless otherwise indicated, wiring shall consist of insulated conductors installed in rigid zinc-coated steel conduit, rigid plastic conduit, electrical metallic and/or nonmetallic tubing, or intermediate metal conduit.

#### **3.2.2 Conduit and Tubing Systems**

Conduit and tubing systems shall be installed as indicated. Conduit sizes shown are based on use of copper conductors with insulation types as described in paragraph WIRING METHODS. Minimum size of raceways shall be 1/2 inch. Only metal conduits will be permitted when conduits are required for shielding or other special purposes indicated, or when required by conformance to NFPA 70. Nonmetallic conduit and tubing may be used in damp, wet or corrosive locations when permitted by NFPA 70 and the conduit or tubing system is provided with appropriate boxes, covers, clamps, screws or other appropriate type of fittings. Electrical metallic tubing may be installed only within buildings. Electrical metallic tubing may be installed in concrete and grout in dry locations. Electrical metallic tubing installed in concrete or grout shall be provided with concrete tight fittings. EMT shall not be installed in damp or wet locations, or the air space of exterior masonry cavity walls. Bushings, manufactured fittings or boxes providing equivalent means of protection shall be installed on the ends of all conduits and shall be of the insulating type, where required by NFPA 70. Only UL listed adapters shall be used to connect EMT to rigid metal conduit, cast boxes, and conduit bodies. Penetrations of above grade floor slabs, time-rated partitions and fire walls shall be firestopped in accordance with Section 07270 FIRESTOPPING. Except as otherwise specified, IMC may be used as an option for rigid steel conduit in areas as permitted by NFPA 70. Raceways shall not be installed under the firepits of boilers and furnaces and shall be kept 6 inches away from parallel runs of flues, steam pipes and hot-water pipes. Raceways shall be concealed within finished walls, ceilings, and floors unless otherwise shown. Raceways crossing structural expansion joints shall be provided with suitable expansion fittings or other suitable means to compensate for the building expansion and contraction and to provide for continuity of grounding.

##### **3.2.2.1 Below Slab-on-Grade or in the Ground**

Electrical wiring below slab-on-grade shall be protected by a conduit system. Conduit passing vertically through slabs-on-grade shall be rigid steel or IMC. Rigid steel or IMC conduits installed below slab-on-grade or in the earth shall be field wrapped with 0.010 inch thick pipe-wrapping plastic tape applied with a 50 percent overlay, or shall have a factory-applied polyvinyl chloride, plastic resin, or epoxy coating system.

##### **3.2.2.2 Exposed Raceways**

Exposed raceways shall be installed parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings.

Raceways under raised floors and above accessible ceilings shall be considered as exposed installations in accordance with NFPA 70 definitions.

#### **3.2.2.3 Changes in Direction of Runs**

Changes in direction of runs shall be made with symmetrical bends or cast-metal fittings. Field-made bends and offsets shall be made with an approved hickey or conduit-bending machine. Crushed or deformed raceways shall not be installed. Trapped raceways in damp and wet locations shall be avoided where possible. Care shall be taken to prevent the lodgment of plaster, dirt, or trash in raceways, boxes, fittings and equipment during the course of construction. Clogged raceways shall be entirely freed of obstructions or shall be replaced.

#### **3.2.2.4 Supports**

Metallic conduits and tubing shall be securely and rigidly fastened in place at intervals of not more than 10 feet and within 3 feet of boxes, cabinets, and fittings, with approved pipe straps, wall brackets, conduit clamps, conduit hangers, threaded C-clamps, or ceiling trapeze. C-clamps or beam clamps shall have strap or rod-type retainers. Rigid plastic conduits (if permitted as a wiring method) shall be supported as indicated above, except that they will be supported at intervals as indicated in NFPA 70. Loads and supports shall be coordinated with supporting structure to prevent damage or deformation to the structures, but no load shall be applied to joist bridging. Fastenings shall be by wood screws or screw-type nails to wood; by toggle bolts on hollow masonry units; by expansion bolts on concrete or brick; by machine screws, welded threaded studs, heat-treated or spring-steel-tension clamps on steel work. Nail-type nylon anchors or threaded studs driven in by a powder charge and provided with lock washers and nuts may be used in lieu of expansion bolts or machine screws. Raceways or pipe straps shall not be welded to steel structures. Holes cut to a depth of more than 1-1/2 inches in reinforced concrete beams or to a depth of more than 3/4 inch in concrete joists shall avoid cutting the main reinforcing bars. Holes not used shall be filled. In partitions of light steel construction, sheet-metal screws may be used. Conduit shall not be supported using wire or nylon ties. Raceways shall be installed as a complete system and be independently supported from the structure. Upper raceways shall not be the support of lower raceways. Supporting means will not be shared between electrical raceways and mechanical piping or ducts and shall not be fastened to hung ceiling supports. Conduits shall be fastened to all sheet-metal boxes and cabinets with two locknuts where required by the NFPA 70, where insulating bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, a single locknut and bushing may be used. Threadless fittings for electrical metallic tubing shall be of a type approved for the conditions encountered. A pull wire shall be inserted in each empty raceway in which wiring is to be installed by others if the raceway is more than 50 feet in length and contains more than the equivalent of two 90-degree bends, or where the raceway is more than 150 feet in length. The pull wire shall be of No. 14 AWG zinc-coated steel, or of plastic having not less than 200 pound per square inch tensile strength. Not less than 10 inches of slack shall be left at each end of the pull wire. Additional support for horizontal runs is not required when EMT rests on steel stud cutouts.

#### **3.2.2.5 Exposed Risers**

Exposed risers in wire shafts of multistory buildings shall be supported by U-clamp hangers at each floor level, and at intervals not to exceed 10 feet.

#### **3.2.2.6 Communications Raceways**

Communications raceways indicated shall be installed in accordance with the previous requirements for conduit and tubing and with the additional requirements that no length of run shall exceed 50 feet for 1/2 inch and 3/4 inch sizes, and 100 feet for 1 inch or larger sizes, and shall not contain more than two 90-degree bends or the equivalent. Additional pull or junction boxes shall be installed to comply with these limitations whether or not indicated. Inside radii of bends in conduits of 1 inch size or larger shall be not less than ten times the nominal diameter.

#### **3.2.2.7 Sizes**

All sizes are based on copper conductors, unless otherwise indicated. Sizes shall be not less than indicated. Branch-circuit conductors shall be not smaller than No. 12 AWG. Conductors for branch circuits of 120 volts more than 100 feet long and of 277 volts more than 230 feet long, from panel to load center, shall be no smaller than No. 10 AWG. Class 1 remote control and signal circuit conductors shall be not less than No. 14 AWG. Class 2 remote control and signal circuit conductors shall be not less than No. 16 AWG.

The conductor sizes are based on the use of TW insulation for conductors smaller than No. 1/0 AWG and THW insulation for conductors No. 1/0 and larger, except where otherwise indicated.

Higher temperature rated conductors will be permitted to be used, if the UL tested temperature ratings for which the equipment in the circuit is marked are not exceeded.

Conductor sizes for nonlinear loads shall be based on the use of minimum 75 degrees C insulated conductors for branch circuits and feeders.

#### **3.2.2.8 Power Conductor Identification**

Phase conductors shall be identified by color coding. The color of the insulation on phases A, B, and C respectively (for three phase) or phases A and B respectively (for single phase) of different voltage systems shall be as follows:

120/208 volt, 3-phase: Black, red, and blue.

Conductor phase and voltage identification shall be made by color-coded insulation for all conductors smaller than No. 6 AWG. For conductors No. 6 AWG and larger, identification shall be made by color-coded insulation, or conductors with black insulation may be furnished and identified by the use of half-lapped bands of colored electrical tape wrapped around the insulation for a minimum of 3 inches of length near the end, or other method as submitted by the Contractor and approved by the Contracting Officer. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made. Phase identification by a particular color shall be maintained continuously for the length of a circuit, including junctions.

#### **3.2.2.9 Control Conductor Identification**

Control circuit conductor identification shall be made by color-coded insulated conductors, plastic-coated self-sticking printed markers, permanently attached stamped metal foil markers, or equivalent means as approved. Control circuit terminals of equipment shall be properly identified. Terminal and conductor identification shall match that shown on approved detail drawings. Hand lettering or marking is not acceptable.

### **3.3 BOXES AND SUPPORTS**

Boxes shall be provided in the wiring or raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways, 4 by 4 inch nominal size and smaller, shall be of the cast-metal hub type when located in normally wet locations, when flush and surface mounted on outside of exterior surfaces, or when located in hazardous areas. Large size boxes shall be NEMA 3R or as shown. Boxes in other locations shall be sheet steel and nonmetallic boxes may be used with nonmetallic conduit and tubing or nonmetallic sheathed cable system, when permitted by NFPA 70. In partitions of light steel construction bar hangers with 1 inch long studs, mounted between metal wall studs or metal stud "C" brackets snapped on and tab-locked to metal wall studs, shall be used to secure boxes to the building structure. When "C" brackets are used, additional box support shall be provided on the side of the box opposite the brackets. The edges of boxes for electrical devices shall be flush with the finished surfaces in gypsum and plasterboard installations. Boxes for mounting lighting fixtures shall be not less than 4 inches square except smaller boxes may be installed as required by fixture configuration, as approved. Boxes installed for concealed wiring shall be provided with suitable extension rings or plaster covers, as required. The bottom of boxes installed in masonry-block walls for concealed wiring shall be flush with the top of a block to minimize cutting of blocks, and boxes shall be located horizontally to avoid cutting webs of block. Indicated elevations are approximate, except where minimum mounting heights for hazardous areas are required by NFPA 70. Unless otherwise indicated, boxes for wall switches shall be mounted 48 inches above finished floors. Switch and outlet boxes on opposite sides of fire rated walls shall be separated by a minimum horizontal distance of 24 inches. Cast-metal boxes installed in wet locations and boxes installed flush with the outside of exterior surfaces shall be gasketed. Separate boxes shall be provided for flush or recessed fixtures when required by the fixture terminal operating temperature, and fixtures shall be readily removable for access to the boxes unless ceiling access panels are provided. Boxes and supports shall be fastened to wood with wood screws or screw-type nails of equal holding strength, with bolts and metal expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel work. Threaded studs driven in by powder charge and provided with lockwashers and nuts, or nail-type nylon anchors may be used in lieu of expansion shields, or machine screws. In open overhead spaces, cast-metal boxes threaded to raceways need not be separately supported except where used for fixture support; cast-metal boxes having threadless connectors and sheet metal boxes shall be supported directly from the building structure or by bar hangers. Hangers shall not be fastened to or supported from joist bridging. Cast-metal boxes with 3/32 inch wall thickness are acceptable. Where bar hangers are used, the bar shall be attached to raceways on opposite sides of the box and the raceway shall be supported with an approved type fastener not more than 24 inches from the box. Penetration of more than 1-1/2 inches into reinforced-concrete beams or more than 3/4 inch into reinforced-concrete joists shall avoid cutting any main reinforcing steel.

#### **3.3.1 Boxes for Use with Raceway Systems**

Boxes for use with raceway systems shall be not less than 1-1/2 inches deep except where shallower boxes required by structural conditions are approved. Sheetmetal boxes for other than lighting fixtures shall be not less than 4 inches square except that 4 by 2 inch boxes may be used where only one raceway enters the outlet. Contractor shall size the telephone outlet boxes as required by the number, size and type of outlets specified and as required by the outlets furnished by the Contractor.



### **3.3.2 Pull Boxes**

Pull boxes of not less than the minimum size required by NFPA 70 shall be constructed of aluminum or galvanized sheet steel, except where cast-metal boxes are required in locations specified above. Boxes shall be furnished with screw-fastened covers. Where several feeders pass through a common pull box, the feeders shall be tagged to indicate clearly the electrical characteristics, circuit number, and panel designation.

### **3.3.3 Clock Outlet**

Clock outlet, for use in other than a wired clock system, shall consist of an outlet box, a plaster cover where required, and a single receptacle with clock-outlet plate. The receptacle shall be recessed sufficiently within the box to allow the complete insertion of a standard cap, flush with the plate. A suitable clip or support for hanging the clock shall be secured to the top of the plate. Material and finish of the plate shall be as specified in paragraph DEVICE PLATES.

### **3.3.4 Conduit Stub-Ups**

Conduits stubbed up through concrete floors for connections to freestanding equipment shall be provided with a short elbow and an adjustable top or coupling threaded inside for plugs, set flush with the finished floor. Wiring shall be extended in rigid threaded conduit to equipment, except that where required, flexible conduit may be used 6 inches above the floor. Screwdriver-operated threaded flush plugs shall be installed in conduits from which no equipment connections are made to suit the devices installed.

## **3.4 DEVICE PLATES**

One-piece type device plates shall be provided for all outlets and fittings. Plates on unfinished walls and on fittings shall be of zinc-coated sheet steel, cast-metal, or impact resistant plastic having rounded or beveled edges. Plates on finished walls shall be of steel with baked enamel finish or impact-resistant plastic and shall be ivory. Screws shall be of metal with countersunk heads, in a color to match the finish of the plate. Plates shall be installed with all four edges in continuous contact with finished wall surfaces without the use of mats or similar devices. Plaster fillings will not be permitted. Plates shall be installed with an alignment tolerance of 1/16 inch. The use of sectional-type device plates will not be permitted. Plates installed in wet locations shall be gasketed and provided with a hinged, gasketed cover, unless otherwise specified.

## **3.5 RECEPTACLES**

### **3.5.1 Single and Duplex**

Single and duplex receptacles shall be rated 15 amperes, 125 volts, two-pole, three-wire, grounding type with polarized parallel slots. Bodies shall be of brown or ivory to match color of switch handles in the same room or to harmonize with the color of the respective wall, and supported by mounting strap having plaster ears. Contact arrangement shall be such that contact is made on two sides of an inserted blade. Receptacle shall be side- or back-wired with two screws per terminal. The third grounding pole shall be connected to the metal mounting yoke. Switched receptacles shall be the same as other receptacles specified except that the ungrounded pole of each suitable receptacle shall be provided with a separate terminal. Only the top receptacle of a duplex receptacle shall be wired for switching application. Receptacles with ground fault circuit interrupters shall have the current rating as indicated, and shall be UL Class A type unless otherwise shown.

Ground fault circuit protection shall be provided as required by NFPA 70 and as indicated on the drawings.

### **3.5.2 Weatherproof Applications**

Weatherproof receptacles shall be suitable for the environment, damp or wet as applicable, and the housings shall be labeled to identify the allowable use. Receptacles shall be marked in accordance with UL 514A for the type of use indicated; "Damp locations", "Wet Locations", "Wet Location Only When Cover Closed". Assemblies shall be installed in accordance with the manufacturer's recommendations.

#### **3.5.2.1 Damp Locations**

Receptacles in damp locations shall be mounted in an outlet box with a gasketed, weatherproof, cast-metal cover plate (device plate, box cover) and a gasketed cap (hood, receptacle cover) over each receptacle opening. The cap shall be either a screw-on type permanently attached to the cover plate by a short length of bead chain or shall be a flap type attached to the cover with a spring loaded hinge.

#### **3.5.2.2 Wet Locations**

Receptacles in wet locations must be installed in an assembly rated for such use whether the plug is inserted or withdrawn, unless otherwise indicated. In a duplex installation, the receptacle cover shall be configured to shield the connections whether one or both receptacles are in use.

### **3.5.3 Receptacles, 15-Ampere, 250-Volt**

Receptacles, 15-ampere, 250-volt, shall be duplex two-pole, three-wire, grounding type with bodies of ivory phenolic compound supported by mounting yoke having plaster ears. The third grounding pole shall be connected to the metal yoke. Each receptacle shall be provided with a mating cord-grip plug.

### **3.5.4 Receptacles, 20-Ampere, 250-Volt**

Receptacles, single, 20-ampere, 250-volt, shall be molded plastic, two-pole, three-wire or three-pole, four-wire, grounding type complete with appropriate mating cord-grip plug.

### **3.5.5 Receptacles, 30-Ampere, 125/250-Volt**

Receptacles, single, 30-ampere, 125/250-volt, shall be molded-plastic, three-pole, three-wire type, complete with appropriate mating cord-grip type attachment plug. Each dryer receptacle shall be furnished with a non-detachable power supply cord for connection to the electric clothes dryer. The cord shall be an angle-type 48 inch length of Type SRD range and dryer cable with three No. 10 AWG conductors.

### **3.5.6 Receptacles, 30-Ampere, 250-Volt**

Receptacles, single, 30-ampere, 250-volt, shall be molded-plastic, three-pole, three-wire type, complete with appropriate mating cord-grip plug.

### **3.5.7 Receptacles, 50-Ampere, 125/250-Volt**

Receptacles, single 50-ampere, 125/250-volt, shall be flush, molded plastic, three-pole, three-wire type. Each range receptacle shall be furnished with a nondetachable power supply cord for connection to the electric range. The cord shall be an angle-type 36 inch length of SRD range and dryer cable with one No. 8 and two No. 6 AWG conductors.

### **3.5.8 Receptacles, 50-Ampere, 250-Volt**

Receptacles, single, 50-ampere, 250-volt, shall be flush molded plastic, three-pole, three-wire type, complete with appropriate mating cord-grip plug.

### **3.5.9 Special-Purpose or Heavy-Duty Receptacles**

Special-purpose or heavy-duty receptacles shall be of the type and of ratings and number of poles indicated or required for the anticipated purpose. Contact surfaces may be either round or rectangular. One appropriate straight or angle-type plug shall be furnished with each receptacle. Locking of receptacles, indicated to be the locking type, shall be accomplished by the rotation of the plug.

## **3.6 WALL SWITCHES**

Wall switches shall be of the totally enclosed tumbler type. The wall switch handle and switch plate color shall harmonize with the color of the respective wall. Wiring terminals shall be of the screw type or of the solderless pressure type having suitable conductor-release arrangement. Not more than one switch shall be installed in a single-gang position. Switches shall be rated 15-ampere 120-volt for use on alternating current only. Pilot lights indicated shall consist of yoke-mounted candelabra-base sockets rated at 75 watts, 125 volts, and fitted with glass or plastic jewels. A clear 6-watt lamp shall be furnished and installed in each pilot switch. Jewels for use with switches controlling motors shall be green, and jewels for other purposes shall be red. Dimming switches shall be solid-state flush mounted, sized for the loads.

## **3.7 SERVICE EQUIPMENT**

Service-disconnecting means shall be of the enclosed molded-case circuit breaker type as indicated with external handle for manual operation. When service disconnecting means is a part of an assembly, the assembly shall be listed as suitable for service entrance equipment. Enclosures shall be sheet metal with hinged cover for surface mounting unless otherwise indicated.

## **3.8 PANELBOARDS AND LOADCENTERS**

Circuit breakers and switches used as a motor disconnecting means, and not in sight of the motor and the driven machinery location, shall be capable of being locked in the open position. Door locks shall be keyed alike. Nameplates shall be as approved. Directories shall be typed to indicate loads served by each circuit and mounted in a holder behind a clear protective covering. Busses shall be copper or aluminum.

### **3.8.1 Loadcenters**

Loadcenters shall be circuit breaker equipped.

### **3.8.2 Panelboards**

Panelboards shall be circuit breaker type or indicated on the drawings.

## **3.9 POWER-SWITCHGEAR AND DEAD FRONT DISTRIBUTION SWITCHBOARDS**

Assemblies shall be metal-enclosed, freestanding general-purpose NEMA 3R type be and shall be installed to provide front access. Busses shall be copper. Assembly shall be approximately 90 inches high; arrangement of circuit breakers and other items specified shall be as indicated. The Ampere

Interrupting Capacity (A.I.C.) rating of the switchboards and circuit breakers shall be based on the maximum fault current available.

### **3.9.1 Circuit Breakers**

Circuit breakers shall be molded-case circuit breakers.

### **3.9.2 Auxiliary Equipment**

#### **3.9.2.1 Instruments**

Instruments shall be long scale, 6.8 inches minimum, semiflush rectangular, indicating or digital switchboard type, mounted at eye level.

- a. Ammeter, range 0 to 1200 amperes, complete with selector switch having off position and positions to read each phase current.
- b. Voltmeter, range 0 to 250 volts, complete with selector switch having off position and positions to read each phase to phase and phase to neutral voltage.

#### **3.9.2.2 Instrument Transformers**

- a. Potential transformers shall be rated 120 to 250 volts.
- b. Current transformers shall be rated 2 to 5 amperes.

### **3.10 FUSES**

Equipment provided under this contract shall be provided with a complete set of properly rated fuses when the equipment manufacturer utilize fuses in the manufacture of the equipment, or if current-limiting fuses are required to be installed to limit the ampere-interrupting capacity of circuit breakers or equipment to less than the maximum available fault current at the location of the equipment to be installed. Fuses shall have a voltage rating of not less than the phase-to-phase circuit voltage, and shall have the time-current characteristics required for effective power system coordination.

#### **3.10.1 Cartridge Fuses; Noncurrent-Limiting Type**

Cartridge fuses of the noncurrent-limiting type shall be Class H, nonrenewable, dual element, time lag type and shall have interrupting capacity of 10,000 amperes. At 500 percent current, cartridge fuses shall not blow in less than 10 seconds. Cartridge fuses shall be used for circuits rated in excess of 30 amperes, 125 volts, except where current-limiting fuses are indicated.

#### **3.10.2 Cartridge Fuses; Current-Limiting Type**

Cartridge fuses, current-limiting type, Class RK5 shall have tested interrupting capacity not less than 100,000 amperes. Fuse holders shall be the type that will reject all Class H fuses.

### **3.11 UNDERGROUND SERVICE**

Unless otherwise indicated, interior conduit systems shall be stubbed out 5 feet beyond the building wall and 2 feet below finished grade, for interface with the exterior service lateral conduits and exterior communications conduits. Outside conduit ends shall be bushed and capped, or plugged until connected to exterior conduit systems. Underground service lateral conductors

will be extended to building service entrance and terminated in accordance with the requirements of Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND and NFPA 70.

### **3.12 MOTORS**

Motors shall be as specified in paragraph Motors, ac, Fractional and Integral Horsepower, whether or not motors are separately provided or included in equipment assemblies specified in other sections of these specifications. Each motor shall conform to the hp and voltage ratings indicated, and shall have a service factor and other characteristics that are essential to the proper application and performance of the motors under conditions shown or specified. Three-phase motors for use on 3-phase 208-volt systems shall have a nameplate rating of 200 volts. Unless otherwise specified, all motors shall have open frames, and continuous-duty classification based on a 40 degree C ambient temperature reference. Polyphase motors shall be squirrel-cage type, having normal-starting-torque and low-starting-current characteristics, unless other characteristics are specified in other sections of these specifications or shown on contract drawings. The Contractor shall be responsible for selecting the actual horsepower ratings and other motor requirements necessary for the applications indicated. When electrically driven equipment furnished under other sections of these specifications materially differs from the design, the Contractor shall make the necessary adjustments to the wiring, disconnect devices and branch-circuit protection to accommodate the equipment actually installed.

### **3.13 MOTOR CONTROL**

Each motor or group of motors requiring a single control and not controlled from a motor-control center shall be provided under other sections of these specifications with a suitable controller and devices that will perform the functions as specified for the respective motors. Each motor of 1/8 hp or larger shall be provided with thermal-overload protection. Polyphase motors shall have overload protection in each ungrounded conductor. The overload-protection device shall be provided either integral with the motor or controller, or shall be mounted in a separate enclosure. Unless otherwise specified, the protective device shall be of the manually reset type. Single or double pole tumbler switches specifically designed for alternating-current operation only may be used as manual controllers for single-phase motors having a current rating not in excess of 80 percent of the switch rating. Automatic control devices such as thermostats, float or pressure switches may control the starting and stopping of motors directly, provided the devices used are designed for that purpose and have an adequate horsepower rating. When the automatic-control device does not have such a rating, a magnetic starter shall be used, with the automatic-control device actuating the pilot-control circuit. When combination manual and automatic control is specified and the automatic-control device operates the motor directly, a double-throw, three-position tumbler or rotary switch shall be provided for the manual control; when the automatic-control device actuates the pilot control circuit of a magnetic starter, the latter shall be provided with a three-position selector switch marked MANUAL-OFF-AUTOMATIC. Connections to the selector switch shall be such that only the normal automatic regulatory control devices will be bypassed when the switch is in the Manual position; all safety control devices, such as low- or high-pressure cutouts, high-temperature cutouts, and motor-overload protective devices, shall be connected in the motor-control circuit in both the Manual and the Automatic positions of the selector switch. Control circuit connections to any MANUAL-OFF-AUTOMATIC switch or to more than one automatic regulatory control device shall be made in accordance with wiring diagram approved by the Contracting Officer unless such diagram is included on the drawings. All controls shall be 120 volts or less unless otherwise indicated.

### **3.13.1 Reduced-Voltage Controllers**

Reduced-voltage controllers shall be provided for polyphase motors 100 hp or larger. Reduced-voltage starters shall be of the single-step autotransformer, reactor, or resistor type having an adjustable time interval between application of reduced and full voltages to the motors. Wye-delta reduced voltage starter or part winding increment starter having an adjustable time delay between application of voltage to first and second winding of motor may be used in lieu of the reduced voltage starters specified above for starting of motor-generator sets, centrifugally operated equipment or reciprocating compressors provided with automatic unloaders.

### **3.13.2 Contacts**

Contacts in miscellaneous control devices such as float switches, pressure switches, and auxiliary relays shall have current and voltage ratings in accordance with NEMA ICS 2 for rating designation B300.

### **3.13.3 Safety Controls**

Safety controls for boilers shall be connected to a 2-wire, 120 volt grounded circuit supplied from the associated boiler-equipment circuit. Where the boiler circuit is more than 120 volts to ground, safety controls shall be energized through a two-winding transformer having its 120 volt secondary winding grounded. Overcurrent protection shall be provided in the ungrounded secondary conductor and shall be sized for the load encountered.

### **3.14 MOTOR-DISCONNECT MEANS**

Each motor shall be provided with a disconnecting means when required by NFPA 70 even though not indicated. For single-phase motors, a single or double pole toggle switch, rated only for alternating current, will be acceptable for capacities less than 30 amperes, provided the ampere rating of the switch is at least 125 percent of the motor rating. Switches shall disconnect all ungrounded conductors.

### **3.15 LAMPS AND LIGHTING FIXTURES**

Ballasted fixtures shall have ballasts which are compatible with the specific type and rating of lamps indicated and shall comply with the applicable provisions of the publications referenced.

#### **3.15.1 Lamps**

Lamps of the type, wattage, and voltage rating indicated shall be delivered to the project in the original cartons and installed in the fixtures just prior to the completion of the project.

##### **3.15.1.1 Incandescent**

Incandescent lamps shall be for 125-volt operation unless otherwise indicated.

##### **3.15.1.2 Fluorescent**

Fluorescent lamps for electronic ballasts shall be as indicated.

##### **3.15.1.3 High-Intensity-Discharge**

High-intensity-discharge lamps shall be the high-pressure sodium type unless otherwise indicated, shown, or approved.

### **3.15.2 Fixtures**

In suspended acoustical ceilings with fluorescent fixtures, the fluorescent emergency light fixtures shall be furnished with self-contained battery packs.

#### **3.15.2.1 Accessories**

Accessories such as straps, mounting plates, nipples, or brackets shall be provided for proper installation. Open type fluorescent fixtures with exposed lamps shall have a wire-basket type guard.

#### **3.15.2.2 Suspended Fixtures**

Suspended fixtures shall be provided with swivel hangers in order to ensure a plumb installation. Pendants, rods, or chains 4 feet or longer excluding fixture, shall be braced to limit swinging. Bracing shall be 3 directional, 120 degrees apart. Single unit suspended fluorescent fixtures shall have twin-stem hangers. Multiple unit or continuous-row fluorescent units shall have a tubing or stem for wiring at one point, and a tubing or rod suspension provided for each length of chassis including one at each end. Maximum distance between adjacent tubing or stems shall be 10 feet. Rods shall be of not less than 3/16 inch diameter. Flexible raceway shall be installed to each fixture from an overhead junction box. Fixture to fixture wiring installation is allowed only when fixtures are installed end to end in a continuous run.

#### **3.15.2.3 Ceiling Fixtures**

Ceiling fixtures shall be coordinated with and suitable for installation in, on, or from the suspended ceiling provided under other sections of these specifications. Installation and support of fixtures shall be in accordance with the NFPA 70 and manufacturer's recommendations. Where seismic requirements are specified herein, fixtures shall be supported as shown or specified. Recessed fixtures shall have adjustable fittings to permit alignment with ceiling panels. Recessed fixtures installed in fire-resistive type of suspended ceiling construction shall have the same fire rating as the ceiling or shall be provided with fireproofing boxes having materials of the same fire rating as the ceiling panels, in conformance with UL-03. Surface-mounted fixtures shall be suitable for fastening to the structural support for ceiling panels.

#### **3.15.2.4 Sockets**

Sockets of industrial, strip, and other open type fluorescent fixtures shall be of the type requiring a forced movement along the longitudinal axis of the lamp for insertion and removal of the lamp.

#### **3.15.3 Emergency Light Sets**

Emergency light sets shall conform to UL 924 with the number of heads as indicated. Sets shall be permanently connected to the wiring system by conductors installed in short lengths of flexible conduit.

### **3.163.17 EQUIPMENT CONNECTIONS**

All wiring not furnished and installed under other sections of the specifications for the connection of electrical equipment as indicated on the drawings shall be furnished and installed under this section of the specifications. Connections shall comply with the applicable requirements of paragraph WIRING METHODS. Flexible conduits 6 feet or less in length shall be

provided to all electrical equipment subject to periodic removal, vibration, or movement and for all motors. All motors shall be provided with separate grounding conductors. Liquid-tight conduits shall be used in damp or wet locations.

#### **3.17.1 Motors and Motor Control**

Control equipment furnished under this section of the specifications, and shown on the drawings, shall be connected under this section of the specifications unless shown or specified otherwise. Except as otherwise specifically noted, automatic-control wiring, signaling, and protective devices are not included in this section of the specifications, but shall be furnished and installed under other sections of the specifications. Control wiring not shown on the drawings shall be furnished under the other sections of the specifications.

#### **3.17.2 Installation of Government-Furnished Equipment**

Wiring shall be extended to the equipment, and proper connections made thereto.

### **3.18 COORDINATED POWER SYSTEM PROTECTION**

A fault-impedance diagram, a load flow analysis or study, a short-circuit analysis or study, and a power system coordination study shall be prepared to demonstrate that protective system after devices have been properly calibrated, adjusted, set and tested. These data, including complete descriptive and technical data of all protective devices, diagrams, and studies as required to ensure complete coordination, shall be prepared in conformance with industry practices, standards, or with other technical data approved by the Contracting Officer, and shall be submitted for approval of the Contracting Officer in accordance with submittal SD-04, Drawings.

#### **3.18.1 Determination of Facts**

The Contractor shall coordinate with the base civil engineering department for short circuit current availability at the site.

#### **3.18.2 Fault-Impedance Diagram**

The diagram shall be prepared to reflect the system impedance of power sources available to supply the building or facility, and the impedance of the new power system components for the facility.

#### **3.18.3 Fault Locations and Short-Circuit Current Availability (SCCA)**

The fault-impedance diagram shall, as a minimum, show fault locations for each voltage transformation and at each power distribution bus. The SCCA available at each fault location shall be shown in tabular form on the diagram for a bolted line-to-line fault and a line-to-ground fault.

#### **3.18.4 Protective Devices**

The time-current characteristics, features, and nameplate data for each existing protective device, including fuses, circuit breakers, and protective relays shall be determined and documented when necessary to ensure coordination between existing and new protective devices. New protective devices proposed, including devices with fixed or adjustable time-current characteristics and features, shall demonstrate proper coordination with existing devices and new and related devices required to:



- a. Minimize the extent of power outages by the operation of the primary protective device nearest the load-side fault location.
- b. Provide back-up protection on the supply-side of the primary protective device if the primary protective device fails to operate.
- c. To ensure a minimum of a 0.2-second delay between the operation of the primary and the back-up, or secondary, protective device unless otherwise approved to prevent nuisance tripping.

#### **3.18.5 Power System Coordination Study**

The study shall include all data related to existing and new protective devices proposed as such data relates to the nameplate data, time-current characteristics, and the fixed or adjustable features of the existing or new protective devices. These data shall include:

- a. The time-current characteristic curves published by the manufacturer of the protective devices or equipment having adjustable time-current characteristics.
- b. Data published by the manufacturer of circuit breakers or protective relays which contain installation, operation and maintenance instructions for calibration, adjustment, setting, and testing of the specific protective device.
- c. Composite time-current characteristic curves for primary, secondary and other related devices, as required to ensure coordinated power system protection between existing and new protective devices or equipment.

#### **3.18.6 Circuit Protective Devices**

The Contractor shall calibrate, adjust, set and test each new adjustable circuit protective device to ensure that they will function properly prior to the initial energization of the new power system under actual operating conditions.

### **3.19 TELEPHONE WIRING SYSTEM**

The telephone wiring system shall be complete and functional.

#### **3.19.1 Telephone Cables**

Each telephone outlet will be serviced with 24-gauge solid copper station-type color coded cable, vinyl insulated with an overall vinyl jacket. Cable shall be continuous from each telephone outlet to backboard indicated on the drawings. Splicing of individual cables shall not be permitted. At each outlet, four-pair cable shall be terminated on the modular jack assembly, using color code provided by the Contracting Officer. At the backboard, terminate the cable on cross-connect terminal blocks and mark with the appropriate outlet number.

#### **3.19.2 Telephone Outlets**

Modular telephone outlets shall comply with FCC Rules and Regulations, Part 68, Subpart F. Each modular outlet shall have a single modular jacks. Each eight-position jack in the modular outlet shall contain screw terminals or approved quick connect terminals for each conductor in the cable. The flush mounted cover shall be ivory. Each outlet shall be numbered for easy identification of type and location.

### **3.19.3 Crossconnect Blocks**

Punch down 66 type connecting blocks shall be provided to terminate all subscriber lines. The blocks shall be attached to right side of the plywood telephone backboard in vertical rows.

### **3.19.4 Telephone Backboards**

Telephone backboards shall be installed at locations shown on the drawings. The backboards shall be 3/4 inch plywood having a two-coat insulating varnish finish and shall be sized as shown on the drawings.

### **3.19.5 Building Entry Protection Modules**

Building Entry Protection Modules shall be provided to terminate the building feeder cable. The modules shall be attached to the left side of the telephone backboard.

### **3.19.6 Auxiliary Devices**

All auxiliary devices such as tie bars, cable rings, etc. which are not shown but are required for a high grade installation shall be provided.

### **3.19.7 Qualifications of Installer**

The system shall be installed by an experienced installer regularly engaged in the installation of telephone systems. The Contracting Officer may reject any proposed installer who can not show evidence of such qualifications.

## **3.20 PAINTING AND FINISHING**

Field-applied paint on exposed surfaces shall be provided under Section 09900 PAINTING, GENERAL.

## **3.21 REPAIR OF EXISTING WORK**

The work shall be carefully laid out in advance, and where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceiling, or other surfaces is necessary for the proper installation, support, or anchorage of the conduit, raceways, or other electrical work, this work shall be carefully done, and any damage to building, piping, or equipment shall be repaired by skilled mechanics of the trades involved, at no additional cost to the Government.

## **3.22 TESTS**

After the interior-wiring-system installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements of this specification. Continuity test shall be conducted on the telephone wiring system. The test shall be performed in the presence of the Contracting Officer. The Contractor shall furnish all instruments and personnel required for the tests, and the Government will furnish the necessary electric power. No part of the electrical distribution system shall be energized prior to the resistance testing of that system's ground rods and submission of test results to the Contracting Officer. Test reports shall indicate the location of the rod and the resistance and the soil conditions at the time the test was performed.

### **3.23 ONE-LINE DIAGRAM**

A one-line diagram with main transformer, building disconnect means, and feeder breakers/switches to building panels located at the building disconnect shall be provided. Diagram shall be mounted under glass or shall be plastic laminated. The breaker/switch identification on the diagram shall match nameplate on the installed equipment.

--End of Section--

## SECTION 16475

### COORDINATED POWER SYSTEM PROTECTION

#### **PART 1 GENERAL**

##### **1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

##### AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI C2 (1993) National Electrical Safety Code
- ANSI C37.16 (1988) Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors - Preferred Ratings, Related Requirements, and Application Recommendations
- ANSI C37.46 (1981; R 1992) Power Fuses and Fuse Disconnecting Switches

##### NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- NEMA AB 1 (1993) Molded Case Circuit Breakers and Molded Case Switches
- NEMA FU 1 (1986) Low Voltage Cartridge Fuses
- NEMA ICS 2 (1993) Industrial Control Devices, Controllers and Assemblies
- NEMA SG 2 (1993) High Voltage Fuses
- NEMA SG 3 (1990) Low-Voltage Power Circuit Breakers
- NEMA SG 5 (1990) Power Switchgear Assemblies

##### NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 70 (1993) National Electrical Code

##### UNDERWRITERS LABORATORIES (UL)

- UL 198C (1986; Rev thru Jun 1993) High-Interrupting-Capacity Fuses, Current-Limiting Types
- UL 198E (1988; Rev Jul 1988) Class R Fuses
- UL 486E (1988; Rev thru Oct 1991) Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
- UL 489 (1991; Rev thru Apr 1994) Molded-Case Circuit Breakers and Circuit-Breaker Enclosures
- UL 508 (1993) Industrial Control Equipment

##### **1.2 SYSTEM DESCRIPTION**

The power system covered by this specification consists of primary utility service to Dorm 19 Complex, transformers and secondary distribution systems to Sectors, A, B, D, and E.

### **1.3 QUALIFICATIONS**

#### **1.3.1 System Coordinator**

System coordination, recommended ratings and settings of protective devices, and design analysis shall be accomplished by a registered professional electrical power engineer with a minimum of two years of current experience in the coordination of electrical power systems.

#### **1.3.2 System Installer**

Calibration, testing, adjustment, and placing into service of the protective devices shall be accomplished by a manufacturer's product field service engineer or independent testing company with a minimum of two years of current product experience in protective devices.

### **1.4 DELIVERY, STORAGE, AND HANDLING**

Devices and equipment shall be visually inspected when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced.

### **1.5 PROJECT/SITE CONDITIONS**

Devices and equipment furnished under this section shall be suitable for the following site conditions:

#### **1.5.1 Altitude**

Altitude: 100

#### **1.5.2 Frequency**

Frequency: 60

#### **1.5.3 Fungus Control**

Fungus Control.

#### **1.5.4 Humidity Control**

Humidity Control.

## **PART 2 PRODUCTS**

### **2.1 STANDARD PRODUCT**

Protective devices and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory utility type use for at least two years prior to bid opening.

### **2.2 NAMEPLATES**

Nameplates shall be provided to identify all protective devices and equipment. Nameplate information shall be in accordance with NEMA AB 1, NEMA SG 3, or NEMA SG 5 as applicable.

### **2.3 CORROSION PROTECTION**

Metallic materials shall be protected against corrosion. Ferrous metal hardware shall be zinc or chrome-plated.

### **2.4 LOW-VOLTAGE MOTOR OVERLOAD RELAYS**

#### **2.4.1 General**

Thermal overload relays shall conform to NEMA ICS 2 and UL 508. Overload protection shall be provided either integral with the motor or controller, and shall be rated in accordance with the requirements of NFPA 70. Standard units shall be used for motor starting times up to 7 seconds.

#### **2.4.2 Construction**

Manual reset type thermal relays shall be melting alloy construction. Automatic reset type thermal relays shall be bimetallic construction. Magnetic current relays shall consist of a contact mechanism and a dash pot mounted on a common frame.

#### **2.4.3 Ratings**

Voltage ratings shall be not less than the applicable circuit voltage. Trip current ratings shall be established by selection of the replaceable overload device and shall not be adjustable. Where the controller is remotely-located or difficult to reach, an automatic reset, non-compensated overload relay shall be provided. Manual reset overload relays shall be provided otherwise, and at all locations where automatic starting is provided. Where the motor is located in a constant ambient temperature, and the thermal device is located in an ambient temperature that regularly varies by more than 18 degrees F, an ambient temperature-compensated overload relay shall be provided.

### **2.5 LOW-VOLTAGE FUSES**

#### **2.5.1 General**

Low-voltage fuses shall be cartridge-type, Class R, Class J, or Class L, with matching fuseholders, as shown. Low-voltage fuses shall conform to NEMA FU 1 and UL 198C or UL 198E as appropriate. Time delay and nontime delay options shall be as specified.

#### **2.5.2 Construction**

Class L fuse contact surfaces shall be plated to ensure low resistance contact. All fuse bodies shall be constructed of high temperature, dimensionally stable, long life, nonhygroscopic materials. All ratings shall be clearly visible.

#### **2.5.3 Ratings**

##### **2.5.3.1 Voltage Ratings**

Voltage ratings shall be not less than the applicable circuit voltage. Nominal voltage ratings, maximum continuous-current ratings, and maximum short-circuit interrupting ratings, shall be in accordance with NEMA FU 1, UL 198C, and UL 198E.

#### **2.5.3.2 Continuous Current Ratings (600 amperes and smaller)**

Service entrance and feeder circuit fuses (600 amperes and smaller) shall be Class RK1, current-limiting, time-delay with 200,000 amperes interrupting capacity.

#### **2.5.3.3 Continuous Current Ratings (greater than 600 amperes)**

Service entrance and feeder circuit fuses (greater than 600 amperes) shall be Class L, current-limiting, time-delay with 200,000 amperes interrupting capacity.

#### **2.5.3.4 Motor and Transformer Circuit Fuses**

Motor, motor controller, transformer, and inductive circuit fuses shall be Class RK1 or RK5, current-limiting, time-delay with 200,000 amperes interrupting capacity.

### **2.6 MEDIUM-VOLTAGE AND HIGH-VOLTAGE FUSES**

#### **2.6.1 General**

Medium-voltage and high-voltage fuses shall conform to NEMA SG 2 and shall be distribution fuse cutouts or power fuses, E-rated, C-rated, or R-rated current-limiting fuses as shown.

#### **2.6.2 Construction**

All fuse contact surfaces shall be plated to ensure low resistance contacts. Fuse body shall be of nonhygroscopic, dimensionally stable shatterproof fiberglass construction. Fuses shall have integral blown-fuse indicators. Open-link cutouts are not acceptable. All ratings shall be clearly visible.

#### **2.6.3 Ratings**

Voltage ratings shall be not less than the applicable circuit voltage. Continuous-current ratings shall be as shown.

##### **2.6.3.1 Expulsion-Type Power Fuses**

Fiber-lined expulsion-type power fuses shall have nominal voltage ratings, maximum continuous-current ratings, and maximum symmetrical short-circuit interrupting ratings as follows:

<u>VOLTAGE, kV</u>	<u>CURRENT, AMPERES</u>	<u>INTERRUPTING, kA</u>
8.3	100, 200, 300, 400	12.5
15.5	100, 200, 300, 400	16.0
25.8	100, 200, 300, 400	20.0
38.0	100, 200, 300, 400	20.0
48.3	100, 200, 300, 400	25.0
72.5	100, 200, 300, 400	20.0
121.0	100, 200	16.0
145.0	100, 200	12.5
169.0	100, 200	12.5

#### **2.6.3.2 E-Rated, Current-Limiting Power Fuses**

E-rated, current-limiting, power fuses shall conform to ANSI C37.46.

#### **2.6.3.3 C-Rated, Current-Limiting Fuses**

C-rated, current-limiting, power fuses shall open in 1000 seconds at currents between 170 and 240 percent of the C rating.

#### **2.6.3.4 R-Rated, Current-Limiting Fuses**

R-rated, current-limiting, fuses shall be used with medium-voltage motor controllers only. R-rated fuses shall conform to ANSI C37.46.

### **2.7 MOTOR SHORT-CIRCUIT PROTECTOR (MSCP)**

#### **2.7.1 General**

Motor short-circuit protectors shall conform to UL 508 and shall be provided as shown. Protectors shall be used only as part of a combination motor controller which provides coordinated motor branch-circuit overload and short-circuit protection, and shall be rated in accordance with the requirements of NFPA 70.

#### **2.7.2 Construction**

Motor short-circuit protector bodies shall be constructed of high temperature, dimensionally stable, long life, nonhygroscopic materials. Protectors shall fit special MSCP mounting clips and shall not be interchangeable with any commercially available fuses. Protectors shall have 100 percent one-way interchangeability within the A-Y letter designations. All ratings shall be clearly visible.

#### **2.7.3 Ratings**

Voltage ratings shall be not less than the applicable circuit voltage. Letter designations shall be A through Y for motor controller Sizes 0, 1, 2, 3, 4, and 5, with 100,000 amperes interrupting capacity rating. Letter designations shall correspond to controller sizes as follows:

CONTROLLER SIZE	MSCP DESIGNATION
NEMA 0	A-N
NEMA 1	A-P
NEMA 2	A-S
NEMA 3	A-U
NEMA 4	A-W
NEMA 5	A-Y



## **2.8 MOLDED-CASE CIRCUIT BREAKERS**

### **2.8.1 General**

Molded-case circuit breakers shall conform to NEMA AB 1 and UL 489 and shall be provided as shown. Circuit breakers may be installed in panelboards, switchboards, enclosures, motor control centers, or combination motor controllers.

### **2.8.2 Construction**

Molded-case circuit breakers shall be assembled as an integral unit in a supporting and enclosing housing of glass reinforced insulating material providing high dielectric strength. Circuit breakers shall be suitable for mounting and operating in any position. Lugs shall be listed for copper conductors only in accordance with UL 486E. Single-pole circuit breakers shall be full module size with not more than one pole per module. Multi-pole circuit breakers shall be of the common-trip type having a single operating handle such that an overload or short circuit on any one pole will result in all poles opening simultaneously. All circuit breakers shall have a quick-make, quick-break overcenter toggle-type mechanism, and the handle mechanism shall be trip-free to prevent holding the contacts closed against a short-circuit or sustained overload. All circuit breaker handles shall assume a position between "ON" and "OFF" when tripped automatically. All ratings shall be clearly visible.

### **2.8.3 Ratings**

Voltage ratings shall be not less than the applicable circuit voltage. The interrupting rating of the circuit breakers shall be at least equal to the available short-circuit current at the line terminals of the circuit breaker and correspond to the UL listed integrated short-circuit current rating specified for the panelboards and switchboards. Molded-case circuit breakers shall have nominal voltage ratings, maximum continuous-current ratings, and maximum short-circuit interrupting ratings in accordance with NEMA AB 1. Ratings shall be coordinated with system X/R ratio.

### **2.8.4 Cascade System Ratings**

Circuit breakers used in series combinations shall be in accordance with UL 489. Equipment, such as switchboards and panelboards, which house series-connected circuit breakers shall be clearly marked accordingly. Series combinations shall be listed in the UL Recognized Component Directory under "Circuit Breakers-Series Connected."

### **2.8.5 Thermal-Magnetic Trip Elements**

Thermal magnetic circuit breakers shall be provided as shown. Automatic operation shall be obtained by means of thermal-magnetic tripping devices located in each pole providing inverse time delay and instantaneous circuit protection. The instantaneous magnetic trip shall be adjustable and accessible from the front of all circuit breakers on frame sizes above 150 amperes.

### **2.8.6 Solid-State Trip Elements**

Solid-state circuit breakers shall be provided as shown. All electronics shall be self-contained and require no external relaying, power supply, or accessories. Printed circuit cards shall be treated to resist moisture absorption, fungus growth, and signal leakage. All electronics shall be housed in an enclosure which provides protection against arcs, magnetic interference, dust, and other contaminants. Solid-state sensing shall measure

true RMS current with error less than one percent on systems with distortions through the 13th harmonic. Peak or average actuating devices are not acceptable. Current sensors shall be toroidal construction, encased in a plastic housing filled with epoxy to protect against damage and moisture and shall be integrally mounted on the breaker. Where indicated on the drawings, circuit breaker frames shall be rated for 100 percent continuous duty. Circuit breakers shall have tripping features as shown on the drawings and as described below:

- a. Long-time current pick-up, adjustable from 50 percent to 100 percent of continuous current rating.
- b. Adjustable long-time delay.
- c. Short-time current pick-up, adjustable from 1.5 to 9 times long-time current setting.
- d. Adjustable short-time delay.
- e. Short-time  $I^2 t$  switch.
- f. Instantaneous current pick-up, adjustable from 1.5 to 9 times long-time current setting.

#### **2.8.7 Current-Limiting Circuit Breakers**

Current-limiting circuit breakers shall be provided as shown. Current-limiting circuit breakers shall limit the let-through  $I^2 t$  to a value less than the  $I^2 t$  of one-half cycle of the symmetrical short-circuit current waveform. On fault currents below the threshold of limitation, breakers shall provide conventional overload and short-circuit protection. Integrally-fused circuit breakers shall not be used.

#### **2.8.8 SWD Circuit Breakers**

Circuit breakers rated 15 amperes or 20 amperes and intended to switch 277 volts or less fluorescent lighting loads shall be marked "SWD."

#### **2.8.9 HACR Circuit Breakers**

Circuit breakers 60 amperes or below, 240 volts, 1-pole or 2-pole, intended to protect multi-motor and combination-load installations involved in heating, air conditioning, and refrigerating equipment shall be marked "Listed HACR Type."

#### **2.8.10 Motor Circuit Protectors (MCP)**

Motor circuit protectors shall conform to NEMA AB 1 and UL 489 and shall be provided as shown. MCPs shall consist of an adjustable instantaneous trip circuit breaker in conjunction with a combination motor controller which provides coordinated motor circuit overload and short-circuit protection. Motor Circuit Protectors shall be rated in accordance with NFPA 70.

### **2.9 LOW-VOLTAGE POWER CIRCUIT BREAKERS**

#### **2.9.1 Construction**

Low-voltage power circuit breakers shall conform to NEMA SG 3 and shall be three-pole, single-throw, stored energy, manually operated, with drawout mounting. Circuit breakers shall have arc quenchers, main and arcing contact structure, a three-phase solid state overcurrent trip device, trip actuator, three tripping transformers, open/close contact position indicator,

charged/discharged stored energy indicator, primary disconnecting devices, and a mechanical interlock to prevent making or breaking contact of the primary disconnects when the circuit breaker is closed. The circuit breaker trip device shall be solid-state and require no external power connections. Circuit breakers shall be equipped with a true, two-step stored energy mechanism providing a maximum 5-cycle closing for automatic synchronizing applications. The charging mechanism of low-voltage power circuit breakers shall normally be accomplished with an electric motor-driven operator or manual operator. In case of motor or power failure or maintenance requirements, the electric motor charging mechanism may be operated manually by a crank or ratchet mechanism. The manual charging lever shall charge the mechanism using either full strokes or an equivalent series of inching strokes. The motor shall charge the mechanism in approximately 5 seconds. Should a loss of control power occur during charging, the operation shall be capable of being completed manually following a breaker close operation.

### **2.9.2 Ratings**

Voltage ratings shall be not less than the applicable circuit voltage. Circuit breakers shall be rated for 100 percent continuous duty and shall have trip current ratings and frame sizes as shown. Nominal voltage ratings, maximum continuous-current ratings, and maximum short-circuit interrupting ratings shall be in accordance with ANSI C37.16. Tripping features shall be as follows:

- a. Long-time current pick-up, adjustable from 50 percent to 100 percent of sensor current rating.
- b. Adjustable long-time delay.
- c. Short-time current pick-up, adjustable from 1.5 to 9 times long-time current setting.
- d. Adjustable short-time delay.
- e. Short-time I square times t switch.
- f. Instantaneous current pick-up, adjustable from 1.5 to 9 times long-time current setting.

## **PART 3 EXECUTION**

### **3.1 VERIFICATION OF DIMENSIONS**

The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

### **3.2 INSTALLATION**

Protective devices shall be installed in accordance with the manufacturer's published instructions and in accordance with the requirements of NFPA 70 and ANSI C2.

### **3.3 FIELD TESTING**

#### **3.3.1 General**

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 30 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all

tests and inspections recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results.

### **3.3.2 Safety**

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

### **3.3.3 Molded-Case Circuit Breakers**

#### **3.3.3.1 General**

Circuit breakers shall be visually inspected, operated manually, and connections checked for tightness. Current ratings shall be verified and adjustable settings incorporated in accordance with the coordination study.

### **3.3.4 Power Circuit Breakers**

#### **3.3.4.1 General**

The Contractor shall visually inspect the circuit breaker and operate the circuit breaker manually; adjust and clean primary contacts in accordance with manufacturer's published instructions; check tolerances and clearances; check for proper lubrication; and ensure that all connections are tight. For electrically operated circuit breakers, the Contractor shall verify operating voltages on closing and tripping coils. The Contractor shall verify fuse ratings in control circuits; electrically operate the breaker, where applicable; and implement settings in accordance with the coordination study.

--End of Section--

## SECTION 16721

### FIRE DETECTION AND ALARM SYSTEM

#### **PART 1 GENERAL**

##### **1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

##### INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41 (1991) Surge Voltages in Low-Voltage AC Power Circuits

##### NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1993) National Electrical Code

NFPA 72 (1993) National Fire Alarm Code

NFPA 90A (1993) Installation of Air Conditioning and Ventilating Systems

##### UNDERWRITERS LABORATORIES (UL)

UL 6 (1993) Rigid Metal Conduit

UL 38 (1994; Rev Jan 1994) Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems

UL 268 (1989; Rev May 1989) Smoke Detectors for Fire Protective Signaling Systems

UL 464 (1990) Audible Signal Appliances

UL 467 (1993) Grounding and Bonding Equipment

UL 521 (1993) Heat Detectors for Fire Protective Signaling Systems

UL 797 (1993) Electrical Metallic Tubing

UL 864 (1991; Rev thru May 1994) Control Units for Fire-Protective Signaling Systems

UL 1242 (1983; Rev thru Jul 1993) Intermediate Metal Conduit

##### **1.2 GENERAL REQUIREMENTS**

###### **1.2.1 Standard Products**

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall be items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that can provide service within 24 hours.

### **1.2.2 Nameplates**

Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a noncorrosive and nonheat-sensitive plate which is securely attached to the equipment.

### **1.2.3 Keys and Locks**

Locks shall be keyed alike.

### **1.2.4 Tags**

Tags with stamped identification number shall be furnished for keys and locks.

### **1.2.5 Verification of Dimensions**

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

### **1.2.6 Compliance**

The fire detection and internal alarm system and the central reporting system shall be configured in accordance with NFPA 72. The equipment furnished shall be compatible and be UL listed or FM approved or approved or listed by a nationally recognized testing laboratory in accordance with the applicable NFPA standards.

### **1.2.7 Manufacturer's Services**

Services of a manufacturer's representative who is experienced in the installation, adjustment, testing, and operation of the equipment specified shall be provided. The representative shall supervise the installation, adjustment, and testing of the equipment.

## **1.3 SYSTEM DESIGN**

### **1.3.1 Operation**

The fire alarm and detection system shall be a complete, supervised fire alarm system. The system shall be activated into the alarm mode by actuation of any alarm initiating device. The system shall remain in the alarm mode until initiating device is reset and the fire alarm control panel is reset and restored to normal. Alarm initiating devices shall be connected to signal line circuits (SLC), Style 5, in accordance with NFPA 72. Alarm indicating appliances shall be connected to indicating appliance circuits (IAC), Style Z in accordance with NFPA 72. A two-loop conduit system shall be provided so that if any one conduit and all conductors contained in that conduit are severed all IAC or SLC on that circuit shall remain functional. A two-loop system is not applicable to the central fire alarm communication center from the local panels. All textual, audible, and visual appliances and systems shall comply with NFPA 72.

Addressable system shall be microcomputer (microprocessor or microcontroller) based with a minimum word size of eight bits.

- a. Sufficient memory shall be provided to perform as specified and as shown for addressable system.

b. Individual identity of each addressable device shall be provided for the following conditions:

- alarm
- trouble
- open
- short
- appliances missing/failed
- remote detector - sensitivity adjustment from the panel for smoke detectors

c. All addressable devices shall have the capability of individually being disabled or enabled from the panel.

### **1.3.2 Operational Features**

The system shall have the following operating features:

a. Electrical supervision of alarm SLC and IAC.

b. Electrical supervision of the primary power (ac) supply, battery voltage, placement of alarm zone module (card, PC board) within the control panel, and transmitter tripping circuit integrity.

c. Trouble buzzer and trouble lamp (light emitting diode or neon light) to activate upon a single break, open, or ground fault condition which prevents the required normal operation of the system. The trouble signal shall also operate upon loss of primary power (ac) supply, low battery voltage, removal of alarm zone module (card, PC board), and disconnection of the circuit used for transmitting alarm signals off-premises. A trouble alarm silence switch shall be provided which will silence the trouble buzzer, but will not extinguish the trouble indicator lamp. After the system returns to normal operating conditions, the trouble buzzer shall again sound until the silencing switch returns to normal position, unless automatic trouble reset is provided.

d. Transmitter disconnect switch to allow testing and maintenance of the system without activating the transmitter but shall provide a trouble signal when disconnected and a restoration signal when reconnected. One person test mode - Activating an initiating device in this mode will activate an alarm for a short period of time, then automatically reset the alarm, without activating the transmitter during the entire process.

e. Evacuation alarm silencing switch or switches which, when activated, will silence alarm devices, but will not affect the zone indicating lamp nor the operation of the transmitter. This switch shall be over-ridden upon activation of a subsequent alarm from an unalarmed zone and the alarm devices will be activated.

f. Electrical supervision of circuits used for supervisory signal services. Supervision shall detect any open, short, or ground.

g. Confirmation or verification modules used on smoke detection initiating circuits. The modules shall interrupt the transmission of an alarm signal to the system control panel for a factory set period. This interruption period shall be adjustable from 1 to 60 seconds and be factory set at 20 seconds. Immediately following the interruption period, a confirmation period shall be in effect during which time an

alarm signal if present will be sent immediately to the control panel. All fire alarm devices other than smoke detectors shall be prohibited on circuits controlled by confirmation or verification modules.

h. Zones for alarm SLC shall be arranged as indicated on the contract drawings.

### **1.3.3 Alarm Functions**

An alarm condition on a circuit shall automatically initiate the following functions:

- a. Transmission of signals over the station radio fire reporting system. The signals shall be different for each zone.
- b. Visual indications of the alarmed zones on the fire alarm control panel annunciator and on the remote annunciator.
- c. Continuous sounding of alarm notification appliances throughout the affected building.
- d. Deactivation of the central air handling units over 2000 cfm throughout the building.

### **1.3.4 Primary Power**

Operating power shall be provided as required by paragraph Power Supply for the System. Transfer from normal to emergency power or restoration from emergency to normal power shall be fully automatic and not cause transmission of a false alarm. Loss of ac power shall not prevent transmission of a signal via the fire reporting system upon operation of any initiating circuit.

### **1.3.5 Battery Backup Power**

Battery backup power shall be through use of rechargeable, sealed-type storage batteries and battery charger.

## **1.4 DELIVERY AND STORAGE**

All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust, and any other contaminants.

## **PART 2 PRODUCTS**

### **2.1 CONTROL PANEL**

Control Panel shall comply with all the applicable requirements of UL 864. Panel shall be modular, installed in a surface mounted steel cabinet with hinged door and cylinder lock. Control panel shall be a clean, uncluttered, and orderly assembled panel containing all components and equipment required to provide the specified operating and supervisory functions of the system. The panel shall have prominent rigid plastic, phenolic or metal identification plates for all lamps, zones, controls, meters, fuses, and switches. Nameplates for fuses shall also include ampere rating. Separate alarm and trouble lamp shall be provided for each zone alarm located on exterior of cabinet door or be visible through the cabinet door. Control panel switches shall be within the locked cabinet. A suitable means shall be provided for testing the control panel visual indicating devices (meters or lamps). Meters and lamps shall be plainly visible when the cabinet door is closed. Signals



shall be provided to indicate by zone any alarm, supervisory or trouble condition on the system. Each SLC initiating circuit shall be powered and supervised so that a signal on one zone does not prevent the receipt of signals from other zones. Loss of power, including any or all batteries, shall not require the reloading of a program. Upon restoration of power, startup shall be automatic, and shall not require any manual operation. The loss of primary power or the sequence of applying primary or emergency power shall not affect the transmission of alarm, supervisory or trouble signals.

#### **2.1.1 Visual Annunciators**

Visual annunciators shall be provided for each active zone. Each lamp shall provide specific identification of the zone by means of a permanently attached rigid plastic, phenolic or metal sign with either raised or engraved letters. Zone identification shall consist of word description of the zone.

#### **2.1.2 Cabinets**

Cabinets shall be provided with ample gutter space to allow proper clearance between the cabinet and live parts of the panel equipment. If more than one modular unit is required to form a control panel, the units shall be installed in a single cabinet large enough to accommodate all units. Cabinets shall have manufacturer's standard finish and color.

#### **2.1.3 Remote System Trouble Audible/Visual Appliance**

Audible appliance shall have a minimum sound level output rating of 100 dBA at 10 feet and operate in conjunction with the panel's integral trouble signal. The audible device shall be silenced by the system trouble silence switch. A rigid plastic, phenolic or metal identification sign which reads "Fire Alarm System Trouble" shall be provided at the audible appliance. The visual appliance located with the audible appliance shall not be extinguished until the trouble has been cleared.

#### **2.1.4 Circuit Connections**

Circuit conductors entering or leaving the panel shall be connected to screw-type terminals with each terminal marked for identification.

### **2.2 STORAGE BATTERIES**

Storage Batteries shall be provided and shall be the sealed, lead-calcium type requiring no additional water. The batteries shall have ample capacity, with primary power disconnected, to operate the fire alarm system for a period of 48 hours. Following this period of operation via batteries, the batteries shall have ample capacity to operate all components of the system, including all alarm signaling devices in the total alarm mode for a minimum period of 30 minutes. Batteries shall be sized to deliver 50 percent more ampere/hours based on a 48 hour discharged rate than required for the calculated capacities. Battery cabinet shall be a separate cabinet beside the main firealarm control panel. Battery shall be provided with overcurrent protection in accordance with NFPA 72.

### **2.3 BATTERY CHARGER**

Battery charger shall be completely automatic, with high/low charging rate, capable of restoring the batteries from full discharge to full charge within 12 hours. A separate ammeter shall be provided for indicating rate of charge. A separate voltmeter shall be provided to indicate the state of the battery charge. A pilot light indicating when batteries are manually placed on a high

rate of charge shall be provided as part of the unit assembly if a high rate switch is provided. Charger shall be located in control panel or battery cabinet.

## **2.4 MANUAL FIRE ALARM STATIONS**

Manual fire alarm stations shall conform to the applicable requirements of UL 38. Manual stations shall be connected into alarm-initiating circuits. Stations shall be installed on semi-flush mounted outlet boxes. Stations shall be single action type. Stations shall be finished in red, with raised letter operating instructions of contrasting color. Stations requiring the breaking of glass or plastic panels for operation are not acceptable. Stations employing glass rods are not acceptable. The use of a key or wrench shall be required to reset the station. Gravity or mercury switches are not acceptable. Switches and contacts shall be rated for the voltage and current upon which they operate. Stations shall have a separate screw terminal for each conductor. Surface mounted boxes shall be painted the same color as the fire alarm manual stations. Addressable pull stations shall be capable of being field programmed, shall latch upon operation and remain latched until manually reset.

## **2.5 FIRE DETECTING DEVICES**

Fire detecting devices shall comply with the applicable requirements of NFPA 72, NFPA 90A, UL 268, and UL 521. The detectors shall be provided as indicated. Detector base shall have screw terminals for making connections. No solder connections will be allowed. Detectors shall be connected into alarm initiating circuits. Detectors located in concealed locations (above ceiling, etc.) shall have a remote visible indicator lamp. Installed devices shall conform to the classification of the area. Addressable fire detecting devices shall be dynamically supervised and uniquely identified in the control panel.

### **2.5.1 Heat Detectors**

Heat detectors shall be designed for detection of fire by fixed temperature. Heat detectors shall be rated for a minimum of 50 foot spacing (smooth-ceiling rated) in accordance with UL 521. Detectors located in areas subject to moisture, exterior atmospheric conditions or hazardous locations as defined by NFPA 70, shall be types approved for such locations. Heat detectors located in attic spaces or similar concealed spaces below the roof shall be intermediate temperature rated.

#### **2.5.1.1 Fixed Temperature Detectors**

Detectors shall be designed for surface or semi-flush outlet box mounting as required by area finishes and supported independently of wiring connections. Detectors are designed to detect high heat. The detectors shall have a specific temperature setting of 57.2 degrees C (135 degrees F).

### **2.5.2 Smoke Detectors**

Detectors shall be designed for detection of abnormal smoke densities. Smoke detectors shall be photoelectric type. Detectors shall contain a visible indicator lamp that shows when the unit is in alarm condition. Detectors shall not be adversely affected by vibration or pressure. Detectors shall be the plug-in type in which the detector base contains terminals for making all wiring connections. Detectors that are in concealed (above false ceilings, etc.) locations shall have a remote visible indicator lamp.

### **2.5.2.1 Ionization Detectors**

Ionization detectors used in conjunction with duct detection shall be equipped with a dual chamber and shall be responsive to both invisible and visible particles of combustion. One chamber shall be a reference chamber and the second a sampling chamber. Detectors containing radium shall not be provided. Detectors shall not cause an alarm condition due to anticipated fluctuations in relative humidity. The sensitivity of the detector shall be field adjustable to compensate for operating conditions. Detector shall require no replacement or readjustment to restore it to normal operation after an alarm condition. Each detector shall be capable of withstanding ambient air velocity up to 300 fpm in accordance with UL 268. Detectors shall have at least a two-stage sensitivity setting, with detectors initially set for normal sensitivity. A lower sensitivity shall be available for each detector. The lower sensitivity shall be within the limits established for that detector by UL or FM.

### **2.5.2.2 Photoelectric Detectors**

Detectors shall operate on a light scattering concept using an LED light source. Failure of the LED shall not cause an alarm condition. Detectors shall be factory set for sensitivity and shall require no field adjustments of any kind. Detectors shall have an obscuration rating between 1.9 and 2.4 percent per foot when tested in accordance with UL 268.

### **2.5.2.3 Duct Detectors**

Duct detectors are provided under Section 15950 Heating, Ventilation, and Air Conditioning HVAC Control Systems.

## **2.6 NOTIFICATION APPLIANCES**

Audible appliances shall be heavy duty and conform to the applicable requirements of UL 464. Devices shall be connected into alarm indicating circuits and shall have a separate screw terminal for each conductor. [Devices shall be painted red. Devices shall have manufacturer's standard finish and color.

### **2.6.1 Alarm Horns**

Horns shall be surface mounted, with the matching mounting back box surface recessed mounted where possible, on concrete walls surface mounted bores shall be used. Horn shall have grill and vibrating type horn suitable for use in an electrically supervised circuit. Horns shall produce a minimum sound rating of at least 85 dBA at 10 feet). Horns used in exterior locations shall be specifically listed or approved for outdoor use and be provided with metal housing and protective grills.

### **2.6.2 Visual Notification Appliances**

Visual notification appliances shall have high intensity optic lens and flash tubes. Strobes shall flash at approximately 1 flash per second and a minimum of 1 candela (8,000 peak candle power). Strobe shall be semi-flush mounted. Where possible except on concrete wall boxes shall be surface mounted.

### **2.6.3 Combination Audible/Visual Notification Appliances**

Combination audible/visual notification appliances shall provide the same requirements as individual units except they shall mount as a unit in standard backboxes. All units shall be factory assembled. Any other audible

indicating appliance employed in the fire alarm systems shall be approved by the authority having jurisdiction.

## **2.7 REMOTE ANNUNCIATION EQUIPMENT**

### **2.7.1 Remote Annunciator**

Annunciator shall have relampable indicator lamps. The lamp (LED) for the proper zone shall light upon any alarm, supervisory or trouble condition on the fire alarm system. Annunciator lamps shall be extinguished only by operating the alarm reset switch on the control panel. Annunciator shall contain a lamp test switch, an audible trouble signal and a trouble silence switch to silence the audible alarm, but not extinguish the trouble lamp. Switches shall be located within a locked panel, and easily visible through a glass or plastic viewing plate. Panel door shall have a keyed lock identical to the lock on the control panel. Zone identification shall be by silk-screened or engraved labels and shall consist of word description of the zone. Annunciator shall be flush mounted.

## **2.8 FIRE DETECTION AND ALARM SYSTEM PERIPHERAL EQUIPMENT**

### **2.8.1 Ground Rods**

Ground rods shall be of copper clad steel conforming to UL 467 not less than 3/4 inch in diameter by 10 feet in length.

### **2.8.2 Conduit**

Conduit and fittings shall comply with UL 6, UL 1242 and UL 797.

### **2.8.3 Wiring**

Wiring for 120V ac power shall be No. 12 AWG minimum. Wiring for low voltage dc circuits shall be No. 14 AWG minimum. Power wiring (over 28 volts) and control wiring shall be isolated. All wiring shall conform to NFPA 70. System field wiring shall be solid copper and installed in metallic conduit or electrical metallic tubing, except rigid plastic conduit may be used under slab-on-grade. All conductors shall be color coded. Conductors used for the same functions shall be similarly color coded. Wiring code color shall remain uniform throughout the circuit. Pigtail or T-tap connections to alarm initiating, supervisory circuits, and alarm indicating circuits are prohibited. T-tapping using screw terminal blocks is allowed for addressable systems.

### **2.8.4 Special Tools and Spare Parts**

Special tools necessary for the maintenance of the equipment shall be furnished. Two spare fuses of each type and size required and five spare lamps and LED's of each type shall be furnished. Two percent of the total number of each different type of detector, but no less than two each, shall be furnished. Fuses shall be mounted in the fire alarm panel.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

All work shall be installed as shown and in accordance with the manufacturer's diagrams and recommendations, unless otherwise specified. Smoke detectors shall not be installed until the building has been thoroughly cleaned.

### **3.1.1 Power Supply for the System**

A single dedicated circuit connection for supplying power to each building fire alarm system shall be provided. The primary power shall be supplied as shown on the drawings. The power supply shall be equipped with a locking mechanism and marked "FIRE ALARM CIRCUIT CONTROL".

### **3.1.2 Wiring**

Conduit size for wiring shall be in accordance with NFPA 70. Wiring for the fire alarm system shall not be installed in conduits, junction boxes, or outlet boxes with conductors of lighting and power systems. No more than one conductor shall be installed under any screw terminal. All circuit conductors entering or leaving any mounting box, outlet box enclosure or cabinet shall be connected to screw terminals with each terminal marked in accordance with the wiring diagram. Connections and splices shall be made using screw terminal blocks. The use of wire nut type connectors are prohibited in the system. Wiring within any control equipment shall be readily accessible without removing any component parts. The fire alarm equipment manufacturer's representative shall be present for the connection of wiring to the control panel.

### **3.1.3 Control Panel**

The control panel and its assorted components shall be mounted so that no part of the enclosing cabinet is less than 12 inches nor more than 78 inches above the finished floor. All manually operable controls shall be between 42 inches above the finished floor. Panel shall be installed to comply with the requirements of UL 864.

### **3.1.4 Detectors**

Detectors shall be installed in accordance with NFPA 72. Detectors shall be at least 12 inches from any part of any lighting fixture. Detectors shall be located at least 3 feet from diffusers of air handling systems. Each detector shall be provided with appropriate mounting hardware as required by its mounting location. Detectors which mount in free space shall be mounted directly to the end of the stubbed down rigid conduit drop. Conduit drops shall be firmly secured to minimize detector sway. Where length of conduit drop from ceiling or wall surface exceeds 3 feet, sway bracing shall be provided.

### **3.1.5 Notification Appliances**

Notification appliances shall be mounted a minimum of 8 feet above the finished floor unless limited by ceiling height or otherwise indicated.

### **3.1.6 Annunciator Equipment**

Annunciator equipment provided shall be mounted where indicated.

## **3.2 OVERVOLTAGE AND SURGE PROTECTION**

All equipment connected to alternating current circuits shall be protected from surges per IEEE C62.41 and NFPA 70. All cables and conductors which serve as communications links, except fiber optics, shall have surge protection circuits installed at each end. Fuses shall not be used for surge protection.

### **3.3 GROUNDING**

Grounding shall be provided to building ground or ground rods shall be driven. Maximum impedance to ground shall be 25 ohms. Ground rods shall not protrude more than 6 inches above grade.

### **3.4 TESTING**

The Contractor shall notify the Contracting Officer 30 days before the preliminary and acceptance tests are to be conducted. The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer. The control panel manufacturer's representative shall be present to supervise all tests. The Contractor shall furnish all instruments and personnel required for the tests.

#### **3.4.1 Preliminary Tests**

Upon completion of the installation, the system shall be subjected to functional and operational performance tests including tests of each installed initiating and notification appliance. Tests shall include the meggering of all system conductors to determine that the system is free from grounded, shorted, or open circuits. The megger test shall be conducted prior to the installation of fire alarm equipment. If deficiencies are found, corrections shall be made and the system shall be retested to assure that it is functional.

#### **3.4.2 Acceptance Test**

Testing shall be in accordance with NFPA 72. The recommended tests in NFPA 72 shall be considered mandatory and shall verify that all previous deficiencies have been corrected. The test shall include the following:

- a. Test of each function of the control panel.
- b. Test of each circuit in both trouble and normal modes.
- c. Tests of alarm initiating devices in both normal and trouble conditions.
- d. Tests of each control circuit and device.
- e. Tests of each alarm notification appliance.
- f. Tests of the battery charger and batteries.
- g. Complete operational tests under emergency power supply.
- h. Visual inspection of all wiring connections.
- i. Opening the circuit at each alarm initiating device and notification appliance to test the wiring supervisory feature.
- j. Ground fault
- k. Short circuit faults
- l. Stray voltage
- m. Loop resistance

### **3.5    TRAINING**

Training course shall be provided for the operations and maintenance staff. The course shall be conducted in the building where the system is installed or as designated by the Contracting Officer. The training period shall consist of 3 training days (8 hours per day) and shall start after the system is functionally completed but prior to final acceptance tests. The instructions shall cover all of the items contained in the operating and maintenance instructions.

--End of Section--